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THE
INDIAN FORESTER.

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A VISIT TO KUCH BEHAR, THE BHUTAN DUARS AND ASSAM.

In Vol. VII. of the "Indian Forester" will be found a short account of some plantations at Kuch Behar which I have lately re-visited, and now give some of the dimensions attained by the different species.

The species planted are teak, sál, sissú and khair, but of these sissú is the only species which appears thoroughly suited to the soil and climate of the place.

Sissú seed was sown in nurseries in 1872, and the seedlings planted out at distances of 16 feet, and although it is evident that if the distance had been less, the boles of the trees would have been straighter than they are, yet the results obtained are very good, as I measured three specimens, respectively 4 feet 2½ inches, 3 feet 7⅝ inches, and 3 feet 9½ inches in girth, at 4 feet from the ground, with a total height of 80 feet and averaging 50 feet of bole. When I saw these trees in 1881, the average girth was 2 feet 3 inches, and the total height 50 feet, so that the rapidity of the growth can be appreciated.

Sissú has now been planted out in a block of about 500 acres on the Kuch Behar-Mogal Haut road, and is doing well, in spite of the whole plantation having been burned this year, for sissú apparently suffers far less from forest fires than sál and many other trees. There are also avenues of fine sissú trees planted along all the roads in the State which are numerous and in good order.

I also measured some sissú trees at Tamai Haut in the Eastern Duars, 24 miles from Kuch Behar, which I had planted out myself in 1878, having taken small natural seedlings from a neighbouring island in the Gadadhar river. One of these measured 2 feet 9 inches in girth at 4 feet from the ground, and was 40 feet in height.

The soil of the town of Kuch Behar is a light colored micaceous sandy loam, and the water level in the monsoon months is only a few feet from the surface, so that building sites are

prepared by digging tanks and throwing up the earth round their banks. Such a soil is evidently not adapted for teak or sál, but besides the sissú, the sau tree, *Albizzia stipulata*, attains fine dimensions on it, in a few years.

The teak plantations were made from nurseries sown in 1874, the seedlings being planted out 6′ × 6′. I measured three of the teak poles and found girths of 2 feet, 2 feet 9 inches, and 2 feet 7⅝ inches, with a height of 55 feet.

Some of the trees are straight and apparently vigorous, but I doubt whether they will ever yield good marketable timber, and many of them have an unhealthy appearance and are unsound at the centre.

The sál plantation still looks flourishing, but the rate of growth is slow, the trees probably suffering from the water-logging of their roots in the monsoon months. They are from seedlings taken from the Baxa sál forest in 1874, and have now an average height of 40 feet, and three specimens measured 1 foot 8 inches, 1 foot 8⅜ inches, and 1 foot 10⅞ inches, at 4 feet from the ground.

The State Superintendent of Agriculture and Forests, Kumar Gojendra Narayan, M.R.A.C., a cousin of the Maharaja's, kindly permitted me to fell one of the poles, which are rather crowded, and on a section of the wood, it was impossible to tell the age by the rings, which were far more in number than the age of the trees would account for. They were also confused, running into one another, and only distinct for a portion of their circumference, and thus agree with Mr. Brandis' description of sál wood.

Cultivation is spreading rapidly all over the Kuch Behar State, but there appears to be little demand for forest produce, as each homestead is surrounded by mango, jack, and other trees and bamboo clumps. Small sál posts are, however, in demand for supports to the mat and bamboo houses, and a certain amount of wood must be required for boats and agricultural purposes, and for bridges and public buildings.

The most notable change which I noticed since I visited Kuch Behar in 1881, is the great extension of tobacco cultivation, which formerly was in small plots for household use, but is now largely carried on for export.

From Kuch Behar I visited Baxa, passing through the great Baxa sál forest.

The large export of railway sleepers has diminished the quantity of mature timber, but some magnificent sál trees are still standing near the Baxa road.

Inferior species, such as akshi (*Dillenia pentagyna*), chilauni (*Schima Wallichii*), sida or dhaura (*Lagerstrœmia parviflora*), are encouraged by the removal of the large sál trees, and it is a pity that improvement fellings, such as we have started in the Dehra Dún forests, in which such trees are girdled over

the young sál seedlings, and afterwards exported as fuel, cannot be started.

But here there appears to be little or no market for any wood but sál, and mere girdling without subsequent removal of the trees would only increase the risk from fire. There are, however, large building works in progress at Kuch Behar, especially the magnificent palace in progress for the Maharaja, and large quantities of fuel are required for bricks, for which mango topes are probably sacrificed as in other parts of India.

It is also strange that all the lime which is being used is imported from Sylhet, though there is plenty of limestone on the Bhutan Hills, and in order to improve the forests, it would be almost worth while to grant to contractors the standing inferior trees in the forest free of charge for lime burning. It is quite possible that teak might succeed in the deep well-drained alluvial soil of the Baxa forest. Baxa is a little Military station at an altitude 2,000 feet on the lower slopes of the Bhutan Hills. It was built after the last Bhutan war to protect from Bhutea raids the Kuch Behar State, and the strip of country acquired from Bhutan termed the Duars, part of which is in the Jalpaiguri District of Bengal, and part in the Goalpara District of Assam.

The commonest indigenous tree in Baxa appears to be *Castanopsis indica*, and the hill above the station, about 6,000 feet high, is covered with a dense evergreen forest of species apparently quite distinct from those of the North-West Himalaya. There are several large caoutchouc trees (*Ficus elastica*) near the regimental parade ground.

The chilauni is very common on the slopes between Baxa and the level of the sál forest as well as on the latter, and large tree ferns abound on the hill sides. On leaving Baxa, I camped through the grassy plains and spreading cultivation of the Duars to Jalpaiguri. On the way we shot some florican, red and black partridges, snipe, wild duck and golden plover, and missed a leopard which killed a goat close to our camp.

Jalpaiguri, on the banks of the Tista river, is no longer a Military station, as it was for several years after the Bhutan war, but is becoming a large centre of trade, and tea cultivation has spread over a large extent of country at the foot of the hills. It is worth notice that 3,000 strawberry plants which I sent there last October from Mussoorie, have grown most vigorously, and have borne a fine crop of fruit from February to May, as the damp climate and sandy soil when well manured suits them admirably.

Here I visited a tea garden belonging to the Tundoo Tea Company, and had a day's mahsír fishing in the Jaldoka river, but only succeeded in hooking one fish. It was at this garden last year that a *must* elephant killed sixteen coolies in one day, and yet I hear that no compensation was paid to their families

by the owner, who is the most influential Zamindar in Berar, but perhaps has never rightly understood what occurred.

The tea seed for these Western Duar tea gardens is imported from Assam, and it is an important question whether tea seed is good when the testa or skin is separated from the embryo inside the shell. I referred this question to Mr. Logan of Dhubri, who for many years passed tea seed on its way from Assam, opening the boxes and testing a certain proportion of the seeds, but his opinion was that provided the embryo was all right, that the separation of the testa was not prejudicial. Mr. Peal also says that opinion is divided on this point, but does not consider it prejudicial provided the seed is fully ripe, and he has promised to test the question thoroughly by planting two lots with and without the testa.

From Jalpaiguri, I went by the Northern Bengal Railway and steamer to Dhubri, and thence by the new daily steamer service to Tezpur, the civil station of the Darrang district in Assam.

The best tea gardens in Darrang are on a plateau of forest land which approaches within 10 miles of the Brahmaputra, and except for the clearings for tea cultivations is covered with virgin forest, known as the Charduar forest, up to the Akha Hills.

A large area consists of pure forest of *Mesua ferrea*, the Assam nahor and Bengal nageswar, the timber of which might surely be utilized for railway sleepers, for which there is a large demand at present, as I hear that the creosoted Norway pine sleepers imported for one of the Bengal Railways have proved a complete failure. The jutili, *Altingia excelsa*, is another social species, and the amari, *Amoora spectabilis*, the sama, *Artocarpus Chaplasha*, the poma, *Cedrela Toona*, and the gondsoroi, *Cinnamonum glanduliferum*, also yield fine timbers and are disseminated through the forest. Whilst old tea gardens with bad jhat of plant are being abandoned in parts of Darrang, the fine young gardens of high class hybrid and Assam indigenous plant on the forest plateau land, and even on grass land below it, are doing very well, even at the present low price of tea, and I hear that Re. 0-10-6 per lb. was the best average price realized in the Darrang district for last year's crop. The dark Assam hybrid plant is now preferred as more hardy than the light-leaved indigenous. These forest gardens, on undulating plateau land surrounded by a wall of *Mesua ferrea* trees, have a singular appearance, but are said to be more healthy than the grass land gardens.

As formerly, the labor question is a great difficulty, but machines are now largely used everywhere, Davidson's Sirocco doing the work of a large range of *chulas*.

To take an example of a fine tea estate, that of the Borelli Company has 7,500 acres of fee simple forest, and uses up annually 35,000 maunds of firewood in its engines, and the wood for 4,500 boxes, each containing 18 superficial feet, or ¾

cubic foot with ½-inch planking, or taking in waste in sawing, we may allow 1 cubic foot per box.

A quantity of timber is also used annually in repairs to buildings, so that perhaps we may some day hear of the large tea companies managing their forests scientifically.

Many gardens which have no private forests still purchase teak boxes in Calcutta, and pay Rs. 2-8-0 each landed at the nearest river-ghât.

I heard that the Assam Company imports 35,000 teak tea boxes annually from Calcutta.

In the Borelli Company's gardens, the steam saw was hard at work preparing wood for tea boxes. I was told that provided the wood was properly dried there was not the slightest fear of its injuring the tea, and all species which would saw well, and are not too heavy or hard, were used, the kochan (*Duabunga sonneratioides*) having the preference. On the islands and banks of the Borelli river there are nearly pure forests of this tree, which is of rapid growth, and a Marwari merchant has started a saw-mill to prepare tea boxes for the planters at the Balipara Haut, which he sells at 1 rupee each.

Mr. Lumsden, the Manager of the Borelli Company, showed me how he was gradually eradicating China plants from his gardens, by pulling them out by ropes attached to an elephant, at the rate of 200 plants per diem. Twenty acres of China plant are thus removed every year, and the ground replanted with indigenous or high class hybrid plant, and the yield thus increased from 2 or 3, to 7 or 8 maunds per acre.

The bad results of former heavy prunings were evident in the diseased stalks of the old tea, many of which were furrowed by white ants up to the top of the bush. The beneficial results on the growth of tea of the sau tree, *Albizzia stipulata*, have attracted the attention of many planters, and I saw for myself that bushes under the shade of this tree were more vigorous than their neighbours.

A small pamphlet on the subject has been published by the Indian Tea Association, in which many Assam planters give their experience on the subject, all being favorable to the sau tree.

Mr. Peal considers that all the Assam *Albizzias*, namely, *A. elata*, *stipulata*, *procera*, *odoratissima*, have the property of improving the growth of tea directly under their shade.

The sau tree has very long superficial roots and bears quantities of seed, the former may assist in draining the soil, and the pods and leaves falling on the ground may enrich it, whilst the shade is not too great to affect the production of leaf in the tea bushes.

The greatest attention is now paid to the water supplied to tea garden coolies, and their huts are far better than those of villagers in the Dún, but there is still a good deal of sickness amongst those freshly imported.

The planters are a fine healthy set of men, and play polo regularly, and the gardens are so numerous, that the old solitary life in the jungles is a thing of the past in Darrang.

It is worth noting that certain species of forest trees spring up naturally in tea gardens. In Darrang the simal has the preference, in the Western Duars it is the kadam, *Anthocephalus Cadamba*. In the Dun, it is the tún, *Cedrela Toona*.

Mr. Campbell, the Forest officer, was not at the Balipara Haut when I arrived, and I therefore visited the caoutchouc plantation with the Forester, but I subsequently met Mr. Campbell, and obtained full information from him about the plantation. About 14,000 plants have now been planted out in lines 40 feet broad and 100 feet from centre to centre, the intervening jungle being left standing to provide a moist atmosphere for the caoutchouc.

The first plants were put out by myself in the spring of 1874, and the following are the heights and girths of 50 trees measured in June 1883:—

Heights and girths of 50 trees measured in each year's plantation since 1874-75.

Year when planted.	Average height.		Average girth.	
	ft.	in.	ft.	in.
1874-75, ...	37	8	2	8
1875-76, ...	34	5	2	1
1876-77, ...	32	3	2	1
1877-78, ...	29	5	1	9
1878-79, ...	23	4	1	1
1879-80, ...	17	5	0	10
1880-81, ...	13	8	0	8

There are about a lakh-and-a-half of seedlings in the nurseries. These are not now planted out until they are 10 feet high and beyond the reach of deer, which formerly grazed down the young transplants. Wild elephants still get in and damage the trees, but the plantation is a great success, and the cost Rs. 72,450, up to end of January 1885, is not too much for Government to pay, on an experiment to produce caoutchouc on a large scale from *Ficus elastica*.

For some time past the price of caoutchouc has been Rs. 80 a maund in Assam, but owing to the market having become overstocked, it has fallen again to about Rs. 40.

It is said that large plantations of ceara rubber are being made in South America, and this may account for the lighter demand.

The rainfall at the Charduar plantation has diminished considerably of late years, as will be seen from the table below, which Mr. Campbell supplied—

Rainfall at the Charduar caoutchouc plantation from 1878-79 to January 1884-85.

	1878-79.	1879-80.	1880-81.	1881-82.	1882-83.	1883-84.	1884-85.	Remarks.
April, ...	4·35	3·79	7·47	6·68	5·35	3·73	2·67	
May, ...	8·10	7·16	4·36	11·94	13·34	13·23	10·55	
June, ...	14·90	36 43	27·83	14·57	15·10	12·61	12·76	
July, ...	16·56	20·58	21 06	10 40	10·58	21·48	12·14	
August, ...	17·03	19·82	20·58	23·81	20 05	18 96	19·07	
September,	16·09	17·05	4·93	21·80	18 26	6 33	7·9	
October, ...	2 64	6·53	12 07	2·18	14·3	0·92	3·3	
November,	·66	...	0·90	0·09	0·68	0·28	0·18	
December,	...	...	1·33	0·28	0 88	1·24	0·37	
January, ...	...	1·87	0·38	1·95	0·54	2·66	0·85	
February,...	...	1·04	0·76	2 42	0 47	1·38	0·50	
March, ...	...	7·52	3·24	2 92	0·22	2·11	1·79	
Total, ...	80·33	121·79	104·91	99·04	99·50	84·93	72 08	

This reduced rainfall may be due to forest clearings in the Assam valley, or it may only be due to unknown causes, and a cycle of heavier rainfall may occur in future years.

The caoutchouc trees in the lines planted in the ground are very healthy and vigorous; a few of those planted up in trees have sent roots down to the ground, and are also forming fine strong crowns, but this method, although it imitates nature, appears to give slow results compared to the plan of planting in the ground.

A fresh experiment of planting out small seedlings in the forks of trees is now being undertaken, and if successful would doubtless greatly diminish the cost of the work.

The right of collecting caoutchouc from the trees growing naturally in the Darrang forests was sold for five years for Rs. 22,000, and will expire in 1886, by which time the natural trees will probably be exhausted. It is impossible to protect them or to regulate the tapping, owing to their being so scattered in the forests. The planters are still afraid of the Akhas, who have not come down this year for their allowance from Government, and a detachment of 50 Sikhs from one of the Assam Regiments is stationed at the Balipara Haut. The two unfortunate Bengali forest subordinates who were carried away last year, both

retired into private life after their release by the Akhas. One of them could not keep up with the raiders, and was carried slung on a pole by his feet and wrists.

I spent two days in mahsír fishing up the Borelli river, but only caught five fish, none exceeding 60 lbs. in weight. Some heavy fish were caught last November by planters, but the fish were evidently shy at my visit.

Mr. Campbell told me that there is a little isolated patch of sál forest in the Lakhimpore district of Assam far east of the Borelli river, which has hitherto been looked on as the eastern limit of sál. He also informed me that coffee planting on a large scale has been commenced in the Nowgong district of Assam.

If coffee planting succeeds in Assam it will be some compensation for the extensive area of new tea cultivation in Ceylon, where splendid yields of leaf have resulted. It is probable, however, that the tea plants will not long stand the forcing climate and seemingly poor soil of Ceylon. All vegetation requires some rest, and the old tea plants in Dehra Dún, where the severe cold of winter and the dry west winds of May and June, necessarily put a long stop to tea making, is still perfectly healthy and free from any blight or disease, and contrasts well in this respect with the more luxuriant plant in Assam, though there are probably tea bushes in the Dún older than any in Assam.

Some experiments in growing the ceara rubber plant, *Manihot Glaziovii*, are being carried out by some tea planters at Tezpur, and there is no doubt that the tree grows luxuriantly in Assam, but no useful result as far as a yield of ceara caoutchouc is concerned has yet been obtained.

After leaving Tezpur, I visited the teak plantation on the Kalsi in Kamrup, and found it fairly flourishing, but the trees on the hilly ground do not look nearly so well as the first lot planted on alluvial soil, of which there is only a small area available above the flood level.

An average tree of 1872, sown by the late Mr. Aylmer, measured 2 feet 9 inches in girth and 60 feet in height, and the largest tree near the river side, and fully exposed to light, was 3 feet 9 inches in girth but only 40 feet high. The trees of the 1873 plantation average 1 foot 5 inches in girth and 40 feet in height, those of 1874 on the hill being about 35 feet high with an average girth of 1 foot 3 inches.

There can be no doubt that the teak in Assam grows much faster than sál, sain (*Artocarpus Chaplasha*) and other good Assam timbers, but to produce really good results a deep well drained alluvial soil above flood level is required. Besides teak there have been attempts to grow caoutchouc, for which the climate is too dry, poma, or tún, *Cedrela Toona*, which does not appear to thrive as well as in the Dún, and jarúl (*Lagerstrœmia Flos-Reginæ*) which is indigenous to the Kalsi valley.

Some maiphak seed supplied by Mr. Peal, which he reported

as a substitute for teak, have been sown, and there are some fine cinchona plants intended to be planted out in the Garo hills. The ceara rubber has also been grown successfully, and a plant from seed sown in 1879, measures 40 feet in height and 2 feet in girth.

The Kalsi forest house is situated on a hill with a fine view of the Kalsi valley with its forest-clad hills, and in the background are the Khasi mountains, rising to a height of 6,000 feet. Sál forest is growing almost everywhere on the rising ground, in many cases surrounding the paddy fields, and owing to the very successful fire conservancy the sál forest has improved wonderfully in the last 10 or 12 years since I first saw it, and is full of fine young growth. But thinnings and removal of badly shaped trees would surely yield some revenue, and would do a world of good. Owing to the absence of a demand for small wood, such thinnings have been neglected here, as in the Baxa forest, only the fine sál trees being sold, and the badly shaped ones being left to encumber the vigorous young growth of poles and saplings.

I append a report by Mr. T. J. Campbell regarding some experiments in collecting caoutchouc, which was published in the Assam Annual Report for 1883-84.

Account of an Experimental Tapping of 50 Caoutchouc or Rubber Trees (Ficus elastica) *in the Balipara Government Reserved Forest, Darrang District, Assam, in 1883.*

"A very interesting experiment was made in the tapping of 50 selected rubber trees in the Balipara Reserve, which was profitable, both in adding to our knowledge of the tree and in its financial aspect.

"The trees selected were located in the range of hills running south of the Bhairabi river after it debouches from the hills, and east of British boundary pillar No. 134. These hills are usually known by the names of the watercources running through them. The western portion is a series of very precipitous hillocks, separated from each other by mountain torrents, richly wooded and containing some of the best timbers. The eastern portion is a series of elevated plateaux with very steep approaches, not so thickly wooded as the western end, but abounding in good timbers. There is a large number of rubber trees in these hills.

"The soil was mostly a rich sandy loam, particularly so in the valleys, where the accumulation of leaf mould was enormous. Some of the trees were on land, low enough to be inundated during the rains.

"All of the trees had commenced life as epiphytes, and in most instances had numerous aerial roots. The trees selected by these epiphytes are almost always those of broad-leaved species, such as Sum, Dhopabor, Serang, &c. The heights, diameter of crown and girths round aerial roots were measured of the selected trees, and the greatest, least and average of these is as follows:—

	Height in feet.	Girth in feet.	Diameter of crown in feet.
Greatest, ...	129	138	195
Average, ...	101	54	94
Least, ...	80	20	56

"The trees were selected, not for their size, which is simply average, but on account of their not having been tapped before, or else having recovered the effects of previous tapping. The trees were marked and numbered for future reference and comparison. The roots were not touched, nor were any incisions made less than 4 feet from the ground or less than 2 feet apart. The following table shows an abstract of the results:—

Locality.	Species.	How collected.	Trees previously tapped.		Trees never tapped before.		Total trees.		Average.		
			No.	Yield in seers.	No.	Yield in seers.	No.	Yield in seers.	Height of trees.	Girth of trees.	Diameter of crown.
									ft.	ft.	ft.
Valleys, ..	Shikabor	Liquid	..	..	3	42·0	3	42·0	113	65	98
" ..	" ..	Dry	7	23·75	6	25 75	13	49·5	100	..	..
" ..	Bogibor	Liquid	..	..	..	..	..	..	..	..	..
" ..	" ..	Dry	8	32 75	5	17·0	13	49·75	102	61	106
Crests of hills	Shikabor	Liquid	..	..	5	74 0	5	74·0	96	68	103
" ..	" ..	Dry	4	18·0	7	27·75	11	45·75	100	47	85
" ..	Bogibor	Liquid	..	..	..	..	..	..	..	..	..
" ..	" ..	Dry	3	11·75	2	8·25	5	20·0	99	48	75
			22	86 25	28	194·75	50	281·0			

	Md.	Srs.		Md.	Srs.
Liquid rubber collected, ...	2	36			
Liquid rubber loss, ...	1	22	sold	1	14
Dry rubber collected, ...	4	5			
Dry rubber loss, ...	0	5	"	4	0
Total, ...				5	14

"The difference between the "Shikabor" and "Bogibor" is simply that the leaves of the latter are of a palish green, instead of the full deep green of the former. The Assamese state that "Shikabor" has a sweet smell which accounts for its name.

"The difference between the "liquid" and "dry" is the mode of extracting. In the former case, small baskets are prepared and coated inside with caoutchouc, after which the basket is attached to the tree under the incision, and receives all the fluid. These baskets, when full, are emptied into cane receptacles coated with caoutchouc, preparatory to boiling down the liquid rubber. When boiled down, the result is usually found to be a loss of from half to two-thirds in weight, and there is a much further decrease during the time the rubber is drying.

"Fifteen seers of liquid rubber were boiled down and weighed five days afterwards, and found to be only 4 seers 6 chhataks: it was then kept ten days longer, when the loss was 6 chhataks more; after which it was kept for a further period of five days without any loss in weight and was then sold.

"Two maunds and 21 seers of rubber were boiled down and weighed the same day and found to be 1 maund and 22 seers; two days afterwards there was a further loss of 11 seers, and the next day 1 more seer. It was sold then, as there was no object in losing revenue through its losing more weight.

"This is decidedly the best way to extract rubber, as the yield is nice and clean, and the mode of extracting it will not admit of the incisions on trees being too close.

"Of the 4 maunds and 5 seers collected in a dry state there was but a loss of 5 seers in weight. This was mainly due to the long time this was allowed to dry on the trees; in some cases 20 days being allowed, instead of the usual 8 to 10 days. In this case, after making the incisions, the milk-like rubber flows freely over the tree, and is allowed to dry there, after which it is torn off, often carrying large quantities of bark with it.

"The trees noted as tapped before were those tapped by Mr. Martin when he leased the mahal. These trees have had from 10 to 15 years' rest, and have entirely recovered, the bark having grown over the incisions again. Their recovery is evident from the fact that their yield is as rich as that of trees never tapped before, though their greater age may have something to do with this.

"The smallness of the yield is surprising and is wholly opposed to all preconceived notions on the subject. This is due to judicious tapping however, the actual possible yield not having been attempted.

"The financial aspect of the tapping was as follows:—

	RS.	A.	P.
Cost of search, collection and superintendence,	143	1	6
Value realized at auction, ...	434	0	0
Profit, ...	290	14	6

"The high value received was due to the excellence of the rubber, which was very clean and without any extraneous mixture of bark, &c."

Mr. Campbell has just informed me that the 50 caoutchouc trees tapped in 1883 and 1884 have been tapped again this year, with a more satisfactory result, 40 trees having yielded 2 maunds 14½ seers of ball rubber and 10 trees 6½ seers of loaf rubber.

Note—Ball rubber means such as is made up out of small pieces and strings of rubber, that are pulled off the bark of the trees where they were allowed to remain and dry from simple exposure to the air after the rubber in its fluid state had run out of the small incisions made in the bark; this kind of rubber is, as a rule, collected from the upper portion of the stem and branches of the trees.

Loaf rubber means such as was collected in a fluid state and then boiled down to assist coagulation, when it is formed into lumps, or loaves of various sizes and solid; this kind of rubber is, as a rule, collected from the lower portion of the stem and large aerial roots of the trees.

GRAZING IN THE FRENCH FORESTS.

In the May Number of this Journal the translation has been given of a note by M. Gazin on the practice of grazing in the mountains of Savoy. We will now proceed to a brief study of the provisions of the French Forest Code on the subject of grazing in the State forests generally.

Art. 63 provides that the Government can free a forest of all rights *in wood* by surrendering entire possession of a portion of the area to the right-holders. Art. 64 goes on to say that other rights of user, including grazing rights, cannot be commuted in this manner, but that they can be bought out by means of compensation fixed by mutual agreement, or in case of dispute by the Courts.

"Nevertheless, the commutation cannot be insisted on by the Forest Department in places where the exercise of the right of grazing has become an absolute necessity for one or more *communes*. If this necessity is disputed by the Department, the parties must go before the *Conseil de préfecture*, which, after an enquiry *de commodo et incommodo*, will decide, subject to an appeal to the *Conseil d'Etat*."

Here it should at once be explained the right of grazing sheep and goats is not included in the above provisions, for Art. 78 stands thus—

"All right-holders are forbidden, in spite of rights and actual enjoyments of the practice to the contrary to drive or cause to be driven goats or sheep into the forests or unwooded tracts belonging to the forests, under penalty, against the owners, of a fine double of that fixed by Art. 199, and against the herdsmen or shepherds of a fine of 15 francs. In case of repetition of the offence, the herdsman will be sentenced, besides the fine, to an imprisonment of from 5 to 15 days. Persons who claim to have enjoyed the above right of sheep-grazing in virtue of valid written titles or of a prescriptive right equivalent to the same can, if their claim is admitted, obtain compensation, the amount of which will be settled by mutual consent, or in case of dispute by the Courts."

"The grazing of sheep can nevertheless be authorized, in certain localities, by royal ordinance"

Neither goats* nor sheep are admitted into any forest which is under the *régime forestier*, as the grazing of these animals is considered incompatible with the maintenance of the ground under wood. The exceptional cases in which "in certain localites" and "by royal ordinance" sheep may be admitted only prove the rule. In localities where the grazing of sheep and goats cannot be prevented, the attempt to preserve the forests as such is not made.

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* The epithets which Manwood's Chief Justice seems to have applied to these animals have very properly been suppressed at p. 135 of Baden-Powell's Manual of Jurisprudence!

To return to Art. 64. When money compensation is awarded in lieu of grazing rights, it is paid on the marked cattle, and there is therefore no difficulty in knowing to whom the money is to go; but nevertheless there are manifest objections to this method of disposing of the right, and the author of an article in the *Revue des Eaux et Forêts*, 1881, page 183, remarks that it is a matter of regret that the law sanctions the exchange of a real servitude, belonging to the communes, for a sum of money, as this is to permit the present generation to dissipate the value of a patrimony as useful to future generations as it has been to those which are passed. Probably the best plan, in case it is absolutely necessary to get rid of the cattle, is to provide them with grazing grounds elsewhere, taking up land and converting it into good pasture where this is necessary; and this appears to be the only possible course in cases where it is decided that the right of grazing is an "absolute necessity" for the people.

Art. 65 of the Code lays down that in State forests which are not freed of grazing rights by the payment of compensation, the exercise of the right of user can always be reduced by the Forest Department in proportion to the condition and *possibilité* of the forest, and that it cannot be exercised at all except in conformity with the regulations contained in the subsequent articles. It is further stated that in case of dispute regarding the *possibilité* and condition of the forests appeal can be made to the *Conseil de préfecture*. By *possibilité* in this case is meant *possibilité* in grass, that is to say, that cattle must not be admitted in excess of the number for which there is a supply of grass, and the ground must not be overgrazed, the grass roots being pulled up and the soil trampled down so that the supply of fodder in future years is diminished. M. Briot says that all ruminants ought to get about 3·3 lbs. of dry grass daily for every 100 lbs. of their weight, but he also remarks on the obvious difficulty that exists in the determination of what the actual *possibilité* in grass of any forest really is. In practice it is not usual to make any calculation of this sort, but the effect of the grazing is carefully watched, and if it is thought that the number of cattle is too large, measures are taken to reduce it. The number must evidently in such a case be reduced somehow or other, not in the interest of the Forest Department, but in that of the people themselves, for if the ground is overgrazed, the production of grass is at any rate temporarily diminished; but the Forest Department also profits indirectly, for if the number of cattle is excessive and the supply of the food they prefer is insufficient for them, they are compelled to browse on the young trees, and thus to damage the forest seriously. All endeavours to reduce the numbers of cattle are, however, usually hotly disputed. As to whether the Forest Department has a right to improve the condition of the forest to the impoverish-

ment of the grass, the law is silent on this subject, but it is certain that grazing can be prohibited to the extent necessary in order to maintain the *status in quo*, whether by planting or sowing or otherwise. Unless, however, the demand on the forest in the matter of grass is less than the *possibilité* as above defined, so that the supply of grass can be diminished without a corresponding reduction in the number of cattle to be admitted, the improvement of the crop of trees in such a manner as materially to reduce the grass supply would at any rate be very strongly opposed by the right-holders ; and in this event it would be desirable, if possible, to do what has been above suggested in the case of forests which it may be wished to free entirely of grazing rights, *viz.*, to provide other grazing grounds to meet the deficiency caused by the improvements.

It is provided by Art. 119 of the general rules made under the Act that every year the local Forest Officers shall establish by a *procès-verbal*, having due regard to the nature, age and situation of the trees, the condition of the blocks of forest under the *régime forestier*, which can be made over for grazing ; they are to indicate the number of animals that can be admitted to them, and the dates on which the exercise of the rights of user may commence and must end. The proposals of the Forest officers are to be submitted for the approval of the Conservator before the 1st February in each year.

Art. 67 of the Code lays down that whatever may be the age or the species of trees, the right-holders can only exercise their rights in the blocks declared out of danger by the Forest Department (subject to an appeal to the *Conseil de préfecture*), and this in spite of all actual enjoyments of the practice.

Art. 68 states that the Forest Department will fix, according to the rights of the right-holders, the number of head of cattle that can be admitted to graze. Who then are the right-holders ?

Art. 61 provides for the extinction of all rights of user not formally recognized either at the date of the promulgation of the present law, or subsequently in consequence of claims made before the tribunals within two years of the date of its promulgation. Art. 62 bars the accrual of fresh rights, and Art. 218 lays down the manner in which claims were to be dealt with. At present then no persons who do not possess formal titles are acknowledged to have any rights. The persons who possess grazing rights are not all owners or occupiers of land, but may be artisans and others. They can of course only possess the right in respect of cattle which are their own *bonâ fide* property. The title rarely prescribes the number of cattle which its holder has the right to graze ; sometimes it permits the exercise of the right without payment, but sometimes fees have to be paid.

Art. 69 of the code provides that every year before the 1st March the Forest Officers shall communicate to the communes

and private persons enjoying rights, the blocks which are declared out of danger and the number of head of cattle which can be admitted to graze ; and the *Maires* are held responsible to publish the information in the communes referred to.

Art. 70 goes on to say that the right-holders can only enjoy pasture rights for cattle kept *for their own use*, and not for those which they buy in order to sell again, under penalty of a fine double of that prescribed by Art. 199. The right then only extends to cattle kept for domestic or agricultural purposes, and does not extend to the animals of cattle-dealers or butchers.

In order to enable the provisions of Art. 69 and 70 of the Code to be carried out, Art. 118 of the General Rules lays down that before the 31st December in each year the *Maires* of communes and private persons enjoying the right of grazing cattle in the State forests, shall submit to the local Forest Officer a statement of the number of head of cattle which each right-holder possesses, distinguishing those which he keeps for his own use from those with which he trades.

In Art. 71 of the Code it is said that the roads by which the cattle must go, in order to pass to and from the pastures, will be pointed out by the Forest Officers. If these roads traverse coppice or young high forest not out of danger, ditches sufficiently wide and deep, or any other kind of fence to prevent the cattle from getting in among the trees, can be made at the joint expense of the right-holders and the Forest Department, and in the manner indicated by the Forest Officers.

Art. 72 provides that the herd of each commune or section of a commune must be in charge of one or more common herdsmen chosen by the Municipal authorities ; as a consequence of this, it is said, the inhabitants of the right-holding communes can neither take charge of their cattle themselves nor send them to graze under a separate guard, under penalty of a fine of two francs per head of cattle. The cattle of each commune or section of a commune are to form a distinct herd unmixed with those of another commune or section, under penalty of a fine of from 5 to 10 francs against the herdsman, and of imprisonment for from five to ten days in case of a repetition of the offence. The communes and sections are held responsible in respect of the sentences involving payment of money which may be pronounced against the herdsmen or guardians of the cattle, as well for the offences treated of in the chapter relating to State forests, as for other forest offences committed by them during the time of their service, and within the limits of the grazing ground. By Art. 73 and 74 of the Code it is provided that the cattle must all be marked with a special mark, (it is usually applied to the skin, but sometimes to the horn) ; the mark must be different for each commune or section, and for every head of cattle not so marked a fine of 3 francs is exacted. The right-holder is held responsible to deposit the impression of his

mark at the Recorder's office of the Court of First Instance, and the marking iron itself at the office of the local Forest Officer, under penalty of a fine of 50 francs. The deposit of the impression and of the iron must be effected before the time fixed for the opening of the grazing (Rule No. 121).

Art. 75 of the Code provides that the right-holders must put bells on the necks of all animals admitted to graze under penalty of a fine of 2 francs for each animal found in the forest without a bell.

Art. 76 lays down that when the cattle of right-holders are found outside the blocks declared out of danger from grazing, or off the roads appointed to reach them by the herdsman, may be fined from 3 to 30 francs, and in case of a repetition of the offence, he may be sentenced in addition to imprisonment for from 5 to 15 days.

Under the provisions of Art. 77, if the right-holders introduce into the forests a greater number of cattle than that which has been fixed by the Forest Department in conformity with Art. 68, they are liable, for the number in excess, to the penalties pronounced in Art. 199.

Regarding stray animals generally Art. 147 provides that persons whose conveyances, cattle, beasts of burden, or beasts for riding are found in the forests off the ordinary roads or paths will be sentenced as follows, *viz.*:—For each conveyance to a fine of 10 francs in case wood is 10 years' old and over, and of 20 francs in case the wood is below that age. For each head of cattle not harnessed in the carriages, to the fines fixed by Art. 199, and this without prejudice to liability for damages.

The last named Article is as follows :—

"The proprietors of animals found by day, unlawfully, in woods of 10 years' old and over, will be sentenced to a fine of

One franc for a pig.
Two francs for a sheep.
Three francs for a horse, pony, mule, donkey.
Four francs for a goat.
Five francs for an ox, cow or calf.

"The fine will be doubled if the wood is less than 10 years' old; all without prejudice to damages if any."

Under Art. 201 of the Code the penalty is always doubled in case of a repetition of the offence (*i.e.*, repetition within a period of 12 months), and when the offences are committed by night. The *proprietors* are prosecuted under Art. 199, and *in addition* the *herdsmen* are prosecuted under Art. 76. As to the area of forest grazing required per head of cattle, this depends on the nature of the rock and soil, climate, slope of the ground, and other fixed elements, as well as on the quantity of grass available and the state of the young growth, which conditions vary from point to point and change from time to time. It is not possible at present to furnish any exact guide. A note by Mr. Brandis

on this subject has appeared in one of last year's Numbers of this Journal, and M. Gazin says that in the Conservatorship of Chambery, Savoy, it is the rule to admit two head of large cattle per hectare (2·47 acres) from the 1st June to the 1st November between sunrise and sunset. This is in fir forests managed under the system of *jardinage*, and in blocks where felling operations have not been carried on for 10 years. It is said that the cattle do not eat the young fir trees. The figures given in the foot-note at page 133 of Mr. Baden H. Powell's Manual relate to the *entire area* of France in the one case, and of the Hautes Alpes in the other, and not as might be supposed to the forest area alone.

M. Briot makes the following statement in the *Revue des Eaux et Forêts* of August 1883 :—

"A word about forest grazing grounds. They are little valued. People would willingly do without them if they could, and even in the *Haute maurvenue*, where the best are found, *viz.*, those which shelter the larch forests, people use them very moderately. We have been told that in the neighbourhood of Mont Cenis, where the Forest Department opens the blocks, which are out of danger, from the 15th May to the 1st November, they are hardly used before the 12th June; after some date between the 28th June to the 4th July the cattle abandon them to disperse themselves over the mountains, except in the case of the highest compartments, in which the cattle of neighbouring pastures come to graze from time to time."

The people then do not require tree-shelter for their cattle, and from this point of view would like the whole country to be cleared of trees.

Much might doubtless be done in India to diminish the necessity for grazing in the Government forests if more attention were paid to the condition of the grazing grounds outside them. At present there is no doubt that the village waste lands are not always cared for as they should be, and that frequently nothing is done to make the most of them. The French Law of 1882 relative to the restoration and preservation of mountainous tracts provides among other things for the regulation of the communal pastures.

M. Briot has written a series of interesting articles in the *Revue des Eaux et Forêts*, 1880-81 and 1883-84, from which much can be learnt regarding the management of the communal grazing grounds in the French Alps. In his article of August 1883, pages 10—23, he gives the substance of various arrangements in force in Savoy.

The commune of Laus-le-Villard, Mont Cenis, gives to each owner of cattle a copy of the *Réglement rural*, of which the principal provisions are of the following nature, *viz.* :—The number of animals of each kind that can be grazed by each person is strictly limited; some of the animals are grazed free, and for others fixed dues are paid : the sheep of strangers found grazing

within the communal pastures are paid for ; grazing in common by cattle and sheep having been found "disastrous."

Separate pastures are assigned for each class ; the dates between which the various classes of pasture are opened are fixed, and the roads by which they are to be approached are indicated ; lastly, the cutting or mowing of grass before the 15th September is prohibited, and even after that date it can only be cut in rocky ground, precipices, and other places which are inaccessible or dangerous for all kinds of animals. This latter provision is of course intended to permit the grass seeds to fall on the ground ; there can be no doubt that precautions with this object are necessary, especially in dry regions, where the production is not vigorous, and that the cutting and burning of the grass before the fall of the seed should be strictly prohibited not less than once in three years.

If some such measures as the above could be taken in India, the demand on the Government forests as grazing grounds might be much reduced.

F. B.

CYPRUS.

It may be useful to some of your readers to know that certain kinds of Eucalyptus are thriving well in the plains of this Island. In 1880-81 the seeds of some 40 species were obtained, and experimental sowings made ; some of the seeds failed to germinate, the seedlings of others soon died off, but the plants of the following ten kinds have taken kindly to the climate and soil, and there are several thousands of them doing very well. These are—

Eucalyptus cordata.
" *coriacea.*
" *corynocalyx.*
" *hemiphloia.*
" *leucoxylon.*
" *occidentalis.*
" *polyanthemus,*
" Red Gum (Tenterfield).
" " (*resinifera*).
" *rostrata.*

Some of the Red Gums have now a height of 30 feet, with a girth from 30 to 36 inches near the base. The above are mostly planted round Government House and the Public Offices, which are situated outside the town ; formerly not a tree existed in the vicinity of these buildings. At first the *E. globulus* was the most generally planted, but their failure has been nearly

complete. Intermixed with the *Eucalyptus* are *Casuarinas*, *Acacias (A. gyanophylla, lophantha* and *pycnantha)*, *Schinus mole* (Pepper plant) and *Thuya*, all doing well, also the *Melia* (Indian Lilac) and *Ailanthus*.

Cyprus at times suffers severely from drought, but the last three years have been favourable, the rainfall averaging 20 inches in the plains. The soil is here mostly calcareous.

It may also be of interest to note that progress is being made towards "Conservancy," 20 square miles on the summits of the Northern mountains are now being closed against goats (cattle and sheep do not pasture on the mountains). Over 30 square miles of the Troodos range 'fellings' of Pines have been prohibited, and it is under consideration to close against pasture the whole or portion of this area. Shortly before the English occupation the cuttings in this forest had been carried on wholesale, and also the damage caused by over-tapping for resin had been immense.

I have lately returned from a visit to Syria, where the little remaining forest on the Lebanon mountains are fast disappearing. It is said the Turkish Government take no measures whatever to protect the forests, and as a result of this denudation, the heat in summer in the Lebanon villages is excessive.

NICOSIA: *1st April, 1885.* — E. DOBBS, *Principal Forest Officer.*

HOW LIGHTNING STRIKES TREES.

I DO not remember seeing the article in February's "Forestry" reprinted in the "Indian Forester," and I do not see "Forestry" itself, so I do not know whether any attempt was made in that article to account for the various phenomena mentioned.

Arago in his Meteorology (I write from recollection after 25 to 30 years) accounts for a tree being struck by the fact that owing to its being full of sap it is a good conductor, and he says that the splintering is caused by the explosive force of the steam into which the sap is suddenly converted.

I do not think that COL. PEARSON's theory fits in with the facts I have observed. In 1871 I was at Simla during the rains, living in a house close to the Church, and a deodar of about 2 feet diameter (perhaps the largest then on the Simla ridge) just behind the house was struck. The upper half of the tree, including most of the branches, was knocked clean off, and the lower half was cleft widely down to the ground, the bark being peeled off in large sheets. There was not much splintering in this case, if I recollect rightly. In the same month, June I think, a small deodar was struck in Simla, and converted into matches, the bark being blown into fragments in all directions and to

some distance. This could hardly have been caused directly by the lightning which, the wet tree being a good conductor, must have passed into the ground; but Arago's theory would account for what happened, always supposing it possible that the sap of the tree could be so instantaneously boiled.

Last year there was a notable case, when a large deodar near the Municipal Hall, Mussoorie, was smashed to pieces. In all these cases, which happened in wet weather, the trees were quite moist, but yet did not escape.

COL. PEARSON thinks that a tree when absolutely dry is nearly a non-conductor, and his impression is that it is then shivered to atoms. I presume he means—when the bark is absolutely dry. But the fact of the tree being struck at all shows that it is a conductor, and this is mainly owing to the sap it contains. Is there any instance of a dead tree having been struck? I have heard of lightning having been seen in Mussoorie to fly off in sparks from a strip of galvanized iron, used as the lightning conductor of an iron roofed house, to a tree close by, to burn the leaves.

Mussoorie. G. W. HOPE.

FLOWERING OF CONIFERS.

I SEND a few notes about flowers and cones of the various pines.

Tos (*Abies Smithiana*).—The pollen began to fall about the 1st of May, and the new cones having become fertilized are fast closing up; in low elevations, 6,500 feet, &c., they are nearly all closed, at 7,500 feet they are still open, and ovules plainly visible. I do not observe any of last year's cones on the trees with the new cones.

The question is when will these new cones ripen? October 1885, or October 1886?

Rhai (*Abies Webbiana*).—Exactly the same as tos; the pollen is now falling, and scales closing up over the ovules.

Kail (or chil) (*Pinus excelsa*).—Same as rhai and tos; but when collecting the male flowers on 16th April last, when they were very young, and long before the pollen was ready to fall, I collected a cone about 2 inches long and over, with the scales all closed up; this would appear to be last year's cone? I have not yet found the new cones of this species, but am looking for them.

Referring to my former letter about the *Pinus longifolia*, it will be seen that I spoke of a second and larger cone which was growing at the base of the stem which held the tiny new cone; this is getting rapidly longer, and must, I should think, be

last year's, which will ripen next April; if so, it would appear that this species takes two years to ripen the seed. I am collecting specimens of all the different cones, and will send hereafter.

5th May, 1885. J. C. McD.

EDINBURGH EXHIBITION.

I SEE from the report on the Indian Section of the Edinburgh Forestry Exhibition that Colonel J. Michael, C.S.I., claims for himself the position as the first practical pioneer of the Forest Department. I do not know whether such claim is appreciated or even acknowledged by the Indian Forest Department.

If it is, I would urge, though I am quite willing to allow that an extremely large number of trees fell under Colonel Michael's direction, that Messrs. Sultan and Ter-Arratoon of the Punjab did as much, and even more, for the introduction of scientific forestry than the gallant Colonel. They cleared whole hill-sides of all parent trees, and thereby necessitated artificial reproduction, and their reckless exploitation forced us to adopt stringent measures of conservancy and methodical working. Honour to whom honour is due, Mr. Editor.

TER.

II. Reviews.

THE TIMBER TREES OF NEW SOUTH WALES.

The little work before us, contained in 142 pages of octavo, is neatly and clearly got up and indexed, and was printed by direction of the Ministry of Mines, Sydney, as a useful and convenient book of reference for Australian Forest officers and others, and we are informed that it is intended to supplement, from time to time, the information given in it. The writer disclaims all originality except the general arrangement of the matter, and terms the book a compilation from previous publications on the subject, and hopes that it may prove a humble forerunner of a work more worthy of the magnificent forests of this Colony.

The book commences with an account of the structure and general characteristics of timber, which being somewhat unscientific, give the popular ideas of exogenous and endogenous wood, the sap ascending through the vessels and descending through the bark, and no distinction is made between the wood of conifers or of *leaf-trees*,† though we get this further on in the book sketched rather imperfectly. We have next the geographical distribution of New South Wales' timber trees, the forests being classified as Brush, Open and Scrub Forests. We quote fully Mr. Nelson's description of each class, which is very striking.

"*The first*, or the *Brush Forests*, are characterized by an extraordinary luxuriance and denseness of growth, great diversity of species, and an almost tropical aspect—most of the trees being of lofty stature and magnificent proportions, with an abundant undergrowth of tree and other ferns, and clothed or adorned above with an almost infinite variety of beautiful mosses, orchids, and other epiphytes, climbers, twiners, and creepers, and intermixed here and there with stately palms, some of which attain a height of 130 feet, while many of the tree-ferns exceed 50 feet in height. The most prevalent kinds of trees are those belonging to the natural families of *Sapindaceæ*, *Proteaceæ*, *Meliaceæ*, *Myrtaceæ*, *Rutaceæ*, *Euphorbiaceæ*, *Urticeæ*, and *Saxifrageæ*. Less common, but still numerous, are representatives of *Leguminosæ*, *Laurineæ*, *Sterculiaceæ*, *Pittos-*

* The Timber Trees of New South Wales, by Arvid Nelson Printed for the Forest Conservancy Branch, Department of Mines, Sydney Thomas Richards, Government Printer, 1884

† *Bois feuillus*, *Laubholz* —[Ed.]

poreæ, *Monimiaceæ*, *Tiliaceæ*, *Sapotaceæ*, *Apocyneæ*, and *Myrsineæ* *Coniferæ*, *Rhamneæ*, *Jasmineæ*, *Ebenaceæ*, *Araliaceæ*, and *Celastrineæ* are represented by several species each, whilst *Anacardiaceæ*, *Anonaceæ*, *Styracaceæ*, *Olacineæ*, *Malvaceæ*, *Capparideæ*, *Santalaceæ*, and *Verbenaceæ*, furnish at least two species each, and about another dozen orders at least one species each. With rare exceptions, this kind of forest is only met with east of the Great Dividing Range, on mountain slopes or terraces, where the soil consists of decomposed trap and other rocks, in sheltered fertile valleys and ravines, or on rich alluvial flats along the courses of rivers and creeks. During the heats of summer the atmosphere in these forests is generally surcharged with moisture and the temperature always more equable than upon adjacent lands with poorer soil and a vegetation either more open or stunted. Bush fires seldom or never occur in these forests, which are frequently difficult to penetrate or explore, owing to inequalities of surface, the presence of rocks or gorges, and the dense and tangled nature of the vegetation. Yet nothing could be more charming and delightful to the beholder, especially where a glade or open vista occurs enabling him to take a comprehensive view of the scenery. Shrubs are rare, and the stems of the trees are seldom cylindrical, but generally of irregular growth, or forming massive angular projections, wings, and buttresses, sometimes of fantastic shape, which together with the mighty branches and the beautiful, dense usually dark green and glossy foliage, and the world of *lianes* and epiphytes clasping and embracing them, are exceedingly picturesque—the peculiar, quivering, green, and almost sunless light, which, even on the brightest day, pervades these recesses, contributing in no small degree to intensify the impression of strangeness, mystery, and delight. But although the scenes are charmed, the difficulties of exploring these forests and ascertaining the true character of the trees are very serious, and, with the exception of the 'Red Cedar,' the 'Pine,' the 'Rosewood,' the 'Ash,' the 'Beech,' the 'Tulipwood,' and the 'Silky Oak,' the most experienced sawyers have frequently no names for the great majority beyond the general designation of 'brush-trees,' and are unable to give any reliable information regarding the qualities of their timber Even the practised botanist sometimes finds himself at a loss in these regions; for the foliage of the trees is so far overhead and so intermingled with that of neighbouring trees and climbers, the trunk so hidden by epiphytes, and the light so uncertain or imperfect, that in most cases a tree has to be cut down before its identity can be determined. Even then it often becomes necessary to cut down several of the neighbouring trees, which have their branches intertwined with it or tied together by the 'bush-ropes,' before the tree will fall and bring the foliage, &c., within the reach of the explorer. No two brush forests are exactly alike, fresh species of trees meeting the traveller as he advances from one brush to another, whilst others disappear The most marked difference in this respect is, perhaps, the absence in the brushes of the southern districts of such trees as the *Araucaria*, the *Flindersia*, the *Castanospermum*, the *Mallotus*, the *Owenia*, and the *Tarrietia*, which are so very prevalent and give almost a distinctive feature to the brushes of the northern districts. Besides the species already mentioned, the 'White Maple,' the dark and

the light 'Yellowwood,' the 'Marblewood,' the 'Coachwood,' the 'Beefwood,' the 'Black Apple,' the 'Red Ash,' the 'Sycamore,' the 'Native Tamarind,' the 'Sassafras,' the 'Native Laurel,' the 'Maiden's Blush,' the 'Negrohead Beech,' the 'Colonial Deal,' the 'Damson,' the 'Corkwood,' the 'Marara,' the 'Lignum-Vitæ,' the 'Blueberry Ash,' the 'Mock Orange,' the 'Native Ebony,' the 'White Sallow,' the 'Native Mulberry,' the 'Turmeric,' the 'Brush Cherry,' the 'Teak,' the 'Native Pear,' the 'Brush Bloodwood,' the 'Giant Nettle,' huge enormous figs, various kinds of 'Hickory' and 'Myrtle,' with numerous gigantic Eucalypti, Pandaneæ, &c., are but a few of the vast number of beautiful and useful trees which are common and have their home and flourish in most of our brush forests.

"As a general rule, the timber produced by the trees of the brush forests is finely grained, often ornamental in texture, and mostly sound at heart, strong, and durable. Even when the trees are of enormous size, and not sound at the butt, they are nearly always solid at no great distance from the root, and differ from those growing in the open forests in being easily worked, and in splitting or clearing freely in planes radiating from the centre.

"*The second*, or the *Open Forests*, are met with in all parts of the Colony except portions of the Monaro, Murrumbidgee, and the Lachlan Districts, where immense 'downs' or treeless salt-bush plains are common. They are composed of trees belonging almost exclusively to the natural order of *Myrtaceæ*, or species of the genera *Eucalyptus*, *Melaleuca*, *Callistemon*, *Angophora*, *Syncarpia*, and *Tristania*, yielding timber which is known by the general name of 'hardwood.' This class of trees is characterized by a more or less naked and lofty stem, with the bark sometimes deeply furrowed or wrinkled and persistent, sometimes smooth and deciduous, or hanging in long strips from the branches; a comparatively small head of persistent, dry, dull-coloured foliage; the branches generally few, sometimes haggard-looking, gnarled, or blown into odd shapes, with the scanty leaves arranged *vertically*, instead of horizontally, and affording the traveller neither shade nor shelter. Most of these trees are found on well-grassed 'ridges,' and grow to a greater size and produce better timber on soil rather poor than otherwise, the more fertile lands frequently producing trees of comparatively small dimensions, thinly scattered over their surface. The rich alluvial flats on the margins of rivers and creeks are exceptions to this rule, being almost always heavily timbered, especially with 'apple-trees' and 'flooded gums.' Some species of Eucalyptus, like the 'Blue gum' and 'Blackbutt,' are of rapid growth, while others, like the 'Ironbark' and the 'Box,' are of exceedingly slow growth. The 'Colonial Pine' (*Araucaria*) and the various kinds of 'Oak' (*Casuarina*) sometimes grow among the trees of the open forests, as well as some species of *Acacia*, especially the 'Myall' and the green and black 'Wattle,' which in many instances take entire possession of vast plains, constituting open forests by themselves. There is much perplexity and confusion in regard to the common names of the various species of *Eucalyptus*, the same name being frequently applied many times over to different species in different localities, but it is hoped that the nomenclature adopted in this essay will be found

as reliable as any hitherto published. The species of *Eucalyptus* of most frequent occurrence are those known as 'Box,' 'Bastard Box,' 'Yellow Box,' 'Stringybark,' 'Ironbark,' 'Blackbutt,' 'Woolybutt,' 'Blue Gum,' 'Red Gum,' 'Flooded Gum,' 'White Gum,' 'Spotted Gum,' 'Grey Gum,' 'Yellow Gum,' 'Drooping Gum,' 'Mountain Ash,' 'Hickory,' 'Leather-jacket,' 'Mahogany,' 'Messmate,' 'Peppermint,' 'Tallowwood,' 'Bloodwood,' &c. The species of *Angophora* are known as 'Apple-trees,' those of *Callistemon* and *Melaleuca* as 'Tea-trees,' while the species of *Syncarpia* are known as 'Turpentine-trees,' and those of *Tristania* as 'White Box,' 'Brush Box,' 'Bastard Box,' 'Hickory,' 'Swamp Mahogany' or 'Water Gum.'

"Perhaps one of the most remarkable and interesting denizens of the open forests is the 'Flooded Gum' of the interior (*Eucalyptus rostrata*), also known as 'Red Gum,' 'White Gum,' or '*Yarrah*,' a tree affecting the banks of rivers, and often attaining a height of over 100 feet. This tree appears to have been a great favourite of Sir Thomas Mitchell's, who records his opinion of it in the following words:—'Its huge gnarled trunk, wild romantic-formed branches, often twisting in coils, shining white or light red bark, and dark masses of foliage, with consequent streaks of shadow below, frequently produced effects fully equal to the wildest forest scenery of Ruysdael or Waterloo. Often as I hurried along did I take my last look with reluctance at scenes forming the most captivating studies. Its shining bark and lofty height inform the traveller of a distant probability of water, or, at least, the bed of a river or lake; and, being visible over all other trees, it usually marks the course of rivers so well, that in travelling along the Darling and Lachlan I could with ease trace the general course of the river, without approaching its banks, until I wished to encamp'

"*The third*, or the *Scrub Forests*, are also common in all parts of the Colony on dry and arid, strong, or sandy land, consisting generally of low short-stemmed, stunted trees, which, with the exception of some kinds of Cypress Pine and Wattles, rarely produce serviceable timber. The great majority of the trees belong to the natural orders of *Leguminosæ*, *Coniferæ*, *Proteaceæ*, and *Myrtaceæ*, the remainder being made up of representatives of such orders as the *Verbenaceæ*, *Santalaceæ*, *Capparidæ*, *Epacrideæ*, *Sapindaceæ*, *Polygonaceæ*, *Pittosporeæ*, *Apocyneæ*, and *Phytolaccaceæ*, while the undergrowth is of an exceedingly varied character, and includes most of the under-shrubs and bush-flowers of the Colony. The botanical characters and affinities of many species found in the scrub forests of the interior are still only imperfectly ascertained and great confusion or uncertainty prevails regarding their local or common names. The most widely-distributed and best-known species are those met with under the names of 'Pine' or 'Cypress Pine,' 'Honeysuckle,' 'Myall,' 'Boree,' 'Silver Wattle,' 'Currawang,' 'Yarren,' 'Berrigan,' 'Quandong,' 'Kurrajong,' 'Dogwood,' 'Swamp Oak,' 'She Oak,' 'He Oak,' 'Bull Oak,' 'Belah,' 'Emu Bush,' 'Hop Bush,' 'Needle Bush,' 'Sifting Bush,' 'Currant Bush,' 'Cotton Bush,' and 'Native Cherry'; less frequent, or less known, generally, are 'Budtha,' 'Coolibah,' 'Goborro,' 'Bimbil,' 'Warrior Bush,' 'Mustard Bush,' 'Umbrella Bush,' 'Mogil-Mogill,' 'Sandal-

wood,' '*Bursaria*,' 'Byrnum,' 'Cuba,' 'Mulga,' 'Wilga,' 'Gidgee,' and 'Modderumbung.' In some parts of Riverina, 'Mallee Scrubs' are formed by three different species of Eucalyptus (*E. dumosa*, *E. incrassata*, and *E. oleosa*), and also by a species of *Myoporum* ('Black Mallee'), while arborescent species of *Muhlenbeckia*, *Polygonum*, and *Viminaria* form impenetrable 'scrubs' in other parts of the interior, and *Avicennia officinalis* constitutes the well-known 'Mangrove' scrubs of the coast districts. The Pine scrubs of Riverina and other parts of the Colony are formed by species of *Frenela*, which are sometimes also found associated with Eucalyptus in the 'Mallee Scrubs.' Bush fires are of frequent occurrence in most of the scrub forests, and probably preclude many of the trees from attaining the dimensions which they might otherwise attain. At each burning most of these trees are killed to the ground, to be reproduced from the collar. Notwithstanding the great number of beautiful flowering herbs and shrubs which inhabit the scrub forests, the impression produced on a traveller by these forests is one of barrenness and desolation. In the daytime the heat is usually oppressive, and shade is unknown; and the whole of the vegetation being evergreen, there appears to be neither summer nor winter, neither spring nor autumn. Most of the flowers are without perfume, and even the forms of animal life met with are unknown in other parts of the world, and generally grotesque in form and manner."

In the next chapter, the timber trees are classified into pine-woods and leaf-woods, the former including *Araucaria Cunninghamii*, various species of *Frenela*, and two species of *Podocarpus*, *elata* and *spinulosa*, which is the beautiful and valuable timber known as Colonial deal.

The leaf-woods are either hardwoods or softwoods, the former from the open forests are rarely sound at heart, slow to kindle, and a few will hardly burn at all, though most of them yield excellent fuel. Some of these woods are impervious to white ants and to the *teredo navalis*, and are said to be probably unequalled in the world for railway sleepers, piles, or those departments of ship-building where great strength is required and a heavy material unobjectionable. The ironbark, of which we cannot ascertain the scientific name from this treatise, but probably *Eucalyptus marginata*, is the best of these timbers. The softwoods are all of the brush forests, except the Casuarinas and Acacias, and a few trees of the scrub forests as well as the conifers which we have already considered.

Our author has divided the softwoods into three sub-classes—(1) Cabinet and fancy woods, (2) Coach-building woods, (3) Stave woods. Under the head of cabinet and fancy woods, the red cedar, our Indian friend *Cedrela Toona*, is placed first as the most useful and valuable of all.

It is said to attain a height of 150 feet with a girth of 10 feet, and to yield sometimes upwards of 30,000 superficial feet of saleable timber per tree.

The great demand for tún timber has completely extirpated

it in many localities, although it was formerly abundant in all the brush forests, and fears are entertained that unless protective measures are shortly taken, it will soon be no longer found in the Colony. Many of the other woods are of great beauty, strength and durability, and often exquisitely veined, marked or fragrant, but are little known and seldom used, though superior to many kinds now largely imported. Amongst the coach-building woods, we have 'coachwood,' *Ceratopetalum apetalum*, and many others.

The silky oak, *Grevillea robusta*, is excellent for cooper's work, as well as the green wattle (*Acacia decurrens*) and the silver wattle (*Acacia dealbata*), and many others whose names are hardly known in India.

An account of how to test by its appearance the kinds of strong and durable timber is next given, and a short paragraph on the influence of soils and climate on trees, in which we find the following extraordinary laws laid down, that amongst different species of trees the strongest timber is yielded by those from the tropics, and amongst trees from the same species by those grown in cold climates. This is certainly not the case with the European oak, and is contrary to the physiological law that wood is better lignified in proportion to the intensity of the light. The best season for felling is said to be when the sap is not circulating, as the sap tends to decompose and to cause the decay of the timber. This is very unscientific, as during the season of rest for vegetation, reserve starchy and sugary material is stored in the sapwood, and therefore the latter is much more liable to decompose than when active vegetation is going on, and there is very little reserve material at all in the wood.

A few remarks are given on seasoning or drying up of the moisture from the woods, which may be either natural or artificial, in the latter a current of hot air being impelled by a fan over the timber when enclosed in a chamber. Some more remarks follow regarding the preservation of timber and its strength, and a table of the proof transverse strength, modulus of rupture, and weight of a cubic foot of 47 kinds of timber is given.

Some of our readers may not know that the *proof transverse strength* of timber is the weight in pounds Avoirdupois which a bar of timber one inch square supported at two points, one foot apart and loaded at the middle, will bear without having its fibre and elasticity impaired in any way.

Then follows an alphabetical list of the New South Wales timber trees arranged according to their scientific names, and with a short description of each, its habitat and uses. Among these, the only Indian species which we noticed are *Avicennia officinalis*, *Casuarina equisitifolia*, *Cedrela Toona*, *Cudrania javanensis*, *Eugenia Jambolana*, *Ficus macrophylla*, *Mallotus philippinensis*, *Melaleuca Leucadendron*, *Sterculia fœtida*, *Symplocos*

spicata, though it is probable that other species of Southern India with which we are not acquainted may also be represented, and there are many Indian genera.

We congratulate the New South Wales Government on the publication of this very useful forest hand-book.

FORESTRY FOR JANUARY AND FEBRUARY, 1885.

In the January Number we find an account of the discussion in the French Chamber of Deputies on the Forest Budget for 1885.

Mr. Lelievre called attention to the deplorable fact that State forestry was unproductive. The net produce from millions of hectares was only 12 francs per hectare. The cause of this was that the present system of forest administration is arbitrary. He proposed as a new system that of *contrôle*, which was a periodic measurement of each tree at 1 metre 33 cents from the ground.

The Minister of Agriculture in reply stated that the fall in the price of wood accounted for the diminution of the revenue, and that if pasturages, sand-dunes, and like unremunerative grounds were subtracted from the State forest area, the yield would be 39 francs per hectare instead of 12 francs as stated by M. Lelievre. As the increase in the young woods is much more rapid than in the older trees, the method founded on the periodic measurement of the trees at fixed periods, say every six years, would be dangerous for the State to adopt, and would also necessitate the services of 300 additional forest agents to effect the continuous measurements.

In accordance with the vote subsequently passed, the Minister of Agriculture will have to suppress 120 superior agents of the service, and it would seem as if the Forest School at Nancy had seen its best days.

The February Number contains several articles of general interest, for example the following extract from that on "Creosoting Timber."

"At the important sleeper-preserving works at Amagne, near Rethel, in the Ardennes, they employ 50 workmen, who prepare 500,000 to 600,000 sleepers yearly. The sleepers are arranged in piles sheltered from rain, but so as to allow the air to play freely through them to dry: after two years or so oak wood loses 20 per cent. of water,—a sleeper weighing originally 81 kilogrammes will then be no more than 65 kilogrammes. The process begins by sleepers laid on little waggons being introduced into a hot-air stove in which the highest temperature is 75 degrees, the middle 60 degrees, and the lowest heat 40 degrees. After two days, the weight of each sleeper is reduced by 1 kilogramme and a little more, rarely 2 kilogrammes. The waggons are next removed to the injection cylinders, which can hold about 180 sleepers. These being hermetically closed,

a vacuum of about 65 degrees is made by the air-pumps, and creosote admitted from a reservoir open to the atmosphere, and kept at a temperature of 70 to 75 degrees by means of steam. When the cylinder is full of the liquid to be injected into the wood, communication with the reservoir is cut off, and steam to the pressure of 5 kilogrammes blown in. Five operations can be performed in a day in each cylinder, the time for each operation being about two hours.

"Square oak sleepers from France, Galicia, and Russian Poland are used. When the oak contains little sap, it absorbs about 5 kilogrammes the sleeper; but Polish oak, which is a little soft, takes a little more in. This preparation costs 1 franc a sleeper. Since 1877, the railway company have mostly eschewed the more tender woods, as sleepers abounding in sap absorbed 17 kilogrammes of creosote. It is essential that the sleepers be thoroughly dried, and that they immediately pass from the drying stove to the injecting cylinder, as only in such circumstances can the liquid enter the wood vessels of the most refractory oak. The drying in the atmosphere should not be too long prolonged; and the use of the stove appears to remove the last traces of moisture. When too many logs are placed in the cylinder, the creosoting becomes unequal."

There are also interesting articles on the Timber Supplies of Great Britain and some of the chief Colonies, compiled from papers by Mr. Simmonds and others, the principal points of which will be found in the following extracts :—

"The immense importance of the extraneous supply of wood to this country was proved by the magnitude of our imports as shown in the Board of Trade returns for the last two years. These exceeded £18,000,000 in value, to say nothing of our home supply of wood, and other forest products brought the total value to over £31,500,000. In 1883, out of 6,647,211 loads imported, only a little over 1,529,000 loads came from India and our Colonies. According to the latest official returns, the areas under woods and forests in the principal countries of Europe amounted to 726,829,119 acres. The great importance of North America for the future timber supply of the world might be deduced from the fact that Canada possessed almost 1,000,000,000 acres of timber lands, and the United States nearly as much. But the United States' shipments for some few years past have become almost stationary at a little over £3,000,000 sterling in value. British India and the other parts of Asia, however, furnished useful supplies of wood, and would contribute more, as the forests were more easily reached by rivers and roads.

"The South American forests had as yet furnished but little timber to Europe, except small supplies from Mexico, Central America, and British Guiana. The magnificent forests of Brazil, with their large varieties of wood, had yet to be drawn upon, but at present were for the most part inaccessible to the wants of commerce. This paper, of which we have made further use in this number, is given at length in the *Journal of the Society of Arts*, No. 1, 674, Vol. xxxiii, December 19th, 1884. London: Bell and Sons. We observe that Mr. Simmonds is to read a further paper before the Indian section of the Society, on 20th February, on the 'Teak Forests of India.'

"The wonderful capabilities of the Jarrah of Western Australia, *E. marginata*, was the theme of the majority of speakers in the discussion following Mr. Simmonds' paper. Of the twelve saw-mills in the colony, the most important are the Jarrahdale Company of Rockingham, with a railway to the port 23 miles long, employing nearly 200 hands; the Western Australian Jarrah Company, at Lockville, with 16½ miles of tramway; Davie's Karridale saw-mills at Augusta and Port Hanelin, with 6 miles of tramway, and employing 100 to 150 men; and the Canning saw-mill, with 8½ miles of tramway, employing about 50 men. In 1882, there were shipped, chiefly to the neighbouring colonies and India, 18,730 loads valued at £93,650, £5 a load; and in 1883, 19,940 loads, valued at £79,760, £4 a load. While there is a palpable diminution in the supply of scented wood (*Santalum cygnorum*), the other valuable export of the colony, Western Australia, has more than 30,000 square miles covered with eucalyptus, 24,000 miles of which consist of the white gum (*E. viminalis*) and jarrah (*E. marginata*). Mr. Simpson, who had thirty-two years' practical experience of the colony, stated that almost everything in Western Australia was made of this timber, work-boxes, pianofortes, buildings, wharves and jetties; it seemed to defy all known forms of decay, and was untouched by white ants and all other insects, so that ships built of it did not require to be coppered. A specimen on the table, cut nearly thirty-two years ago, which had been exposed to bush fires, to the summer sun of Australia, and to wind and rain in the wet season, was as sound now as the day it was felled. Another as sound piece was exhibited cut from a bridge certified by the Government resident to have been thirty-six years in use. There were about fifteen varieties of the timber, and it could be obtained of any reasonable length up to 60 or 80 feet, the trunk of the tree having no branches whatever. It did not burn freely, but only charred. If a sheet of glass and a piece of this timber were put into a white ant's nest, the ants would bore through the glass rather than touch the jarrah.

"According to Mr. Simmonds, the forest land of New Zealand was estimated at 12,130,000 acres in 1873, being nearly equally distributed betwixt the North and South Islands; but this area has much diminished within the last ten years.

"Many of the more valuable trees of Europe, America, and Australia which have been introduced, attain a vigour almost beyond that of their native habitats.

"The New Zealand woods vary very much among themselves. Many varieties are very durable—manuka (*Leptospermum ericoides*), totara (*Podocarpus Totara*), kauri (*Dammara australis*), black birch (*Fagus fusci*), kowhai (*Sophora tetraptera*), and matai (*Podocarpus spicata*) appear to be the most useful and highly esteemed.

"*Kauri* is the finest forest tree and attains a height of 120 to 160 feet. The trunk is sometimes 80 to 100 feet high before branching, and attains a diameter at the base of 10 to 20 feet. The timber is in high repute for masts and spars, deck and other planking of vessels, railway sleepers, and house-finishing. There is evidence of its durability for more than 50 years in some of the old mission buildings at the Bay of Islands, and other constructions. It forms the bulk of the timber exported from New Zealand, but only grows

in the North Island. It makes a rich and valuable furniture wood, some of the largest and soundest kauri timber having richly-mottled shading.

"On an average, the kauri pine may be estimated as yielding, when sawn into conveniently-sized boards, between 6,000 or 7,000 feet of timber. The annual cut of this timber is about 110,000,000 feet. The trees cover about 180,000 acres, and the estimate of the timber is set down at 23,000 million feet.

"Victoria, Mr. Simmonds states, imports much more timber than she exports. Soft woods imported in 1883 were valued at £706,424, but her timber exports were estimated at £43,127. She has still forest reserves of indigenous eucalypts amounting to nearly 40,000 square miles, in which the stringy bark (*E. obliqua*) covers 25,000 square miles, while there are 8,000 squares miles of the large white and red gums (*E. amygdalina* and *E. rostrata*).

"New South Wales, as is well known, abounds in valuable hardwoods. The banks of the coast rivers are supplied with a luxuriant growth of timber. There are 27 species of eucalypts alone."

In 1883 upwards of 8,829,754 superficial feet of timber were exported from this colony, which in the same year imported 47,565,000 superficial feet and with other wood valued at £403,547.

"Irrespective of the immense home consumption in Queensland, there is a large export trade, ranging in value from £30,000 to £60,000. Already the Government have seen it necessary to pass a measure for the conservation of the red cedar (*Cedrela Toona.*) This tree grows to a height of 100 to 150 feet, with a diameter ranging from 3 to 7 feet, is easily worked, and is in dry situations very durable. Some trees have been cut on the Richmond river yielding 30,000 feet of saleable timber. The market value of this tree in Queensland is from 20 shillings per hundred superficial feet, according to colour and size. It is only at open forest bushes.

"The great timber-producing area of Canada has as yet only been confined to the *third* and *fourth forest* zones of the Dominion, the region of the *white and red pine* extending from Lake of the Woods and Lake Nepigon to Anticosti, thence to the Georgian Bay, Lower Ottawa river, and Nova Scotia; and the region of *beech and maple* occupying those parts of Ontario and Quebec lying south of the zone of the pines. Immediately west of Lake Superior, many of the most important trees, as white pine, basswood, red oak, and sugar maple, are no longer found. The prairie appears to form a barrier to westward distribution. As pointed out in another article, the Canadian Pacific Railway in its westward course passes through the other two forest regions; first that of *the poplars*, terminating in that of the *Douglas fir*. Of 95 species of forest trees in Canada, Ontario has 65 species, of which 61 are found in the districts bordering on Lake Erie. Of these 65 species, 52 extend eastward to the Province of Quebec, 35 are found on the easterly and westerly sides of Lake Superior, whilst only 14 range westerly into the prairie country at and beyond the Red River.

"Again, in British Columbia there are 35 species, of which only

seven are well distributed over the whole Dominion. Only three Canadian trees are identical with European species—the chestnut, white birch, and yew."

REPORT OF THE BOTANICAL AND AFFORESTATION DEPARTMENT, HONGKONG, 1884.

Mr. Ford, the Superintendent of the Botanical and Afforestation Department in Hongkong, has written a short but interesting report, which is accompanied by a map of Hongkong on a scale of 4 inches to the mile, and another of British Kowloong on a scale of 1 inch = 400 feet, showing the areas planted up, which already cover a considerable area.

The exceptionally sterile nature of the "barren rock" of Hongkong, the exposed aspect and absence of water in the dry season, present many difficulties; and the typhoon of last September, accompanied by a deluge of rain, appears to have done a great deal of mischief.

It is curious to note that Chinese, unlike Indians, cannot learn the foreign names of plants, and do not therefore render any assistance in labelling. Mr. Ford notes that ants are very destructive in gardens, but have objections to crossing a line saturated with a solution of one part of carbolic acid to 50 parts of water, which should be watered round seed-beds.

A list of additions to the Hongkong flora is published, and Mr. Ford hopes that the Hongkong herbarium will become in time the chief herbarium in China.

The number of China pines, *Pinus sinensis*, planted out is 318,859, and 384,000 sown *in situ*, and this appears to be the only tree really suited to the locality.

About 9,000 plants of 14 species of eucalyptus have also been planted out, species indigenous in Queensland having been selected as most suitable to the climate of Hongkong. About 40,000 plants of *Aleurites vernicii* have been planted out.

Some cork oak acorns brought from Spain have been sown in the nurseries, and about one in four have germinated.

III. Official Papers.

THE BOXWOOD FORESTS OF KUMAUN AND BRITISH GARHWAL.*

The box forests of Kumaun and Garhwál are generally found on slopes with a north or north-west aspect, and at an elevation of from 7,000 to 9,000 feet.

Box is either found occupying a limited area, in which case it is often the dominant species, or else distributed regularly through extensive forests and mixed with other species, and it is in this condition that the finest trees are formed. On gentle, well-watered slopes, more particularly near the bottoms of ravines, where the soil is rich and the cover dense, the box finds the conditions of vegetation best suited to it. In these vast forests, often almost untouched by the hand of man, the ground is in the most favourable condition for forest vegetation. The detritus of generations, the fallen leaves and rotting branches and wood, have formed a deep and fertile humus, giving a perfect forest soil. The rock is generally limestone, huge boulders of which are often found scattered through the forest. The thicker and more dense the forest, the better the box. The full light crushes down the tree, as the shade does most other species. In open glades it is often found in considerable numbers, but always stunted and pressed down. The open light, then, appears to facilitate the germination of the seed, but to oppose the free growth of the tree.

Box is rarely found far from the snowy range. When quite close to the snows, however, though often numerous, it is badly grown and of little value. Thus the forests of Trijugi Narain and Tali Gwar contain a great number of trees, but they are stunted and crooked. This is probably due to the heavy snowfall of these places. The most important trees found associated with box are :—

* Report by F. B Bryant, Esq, Assistant Conservator of Forests, on the Box Forests of Kumaun and Garhwal.

Karshu,	..	..	..	*Quercus semicarpifolia.*
Moru,	..	..	..	*Quercus dilatata.*
Rai,	..	..	..	*Abies Smithiana.*
Morinda,	..	..	..	*Abies Webbiana* (rarely).
Panghar,	..	..	..	*Æsculus indica.*
Maple,	..	..	..	*Acer villosum.*
"	..	..	..	*Acer lævigatum.*
Yew,	..	..	..	*Taxus baccata.*
Walnut,	..	..	..	*Juglans regia.*
Holly,	..	..	..	*Ilex dipyrena.*
Cypress,	..	..	..	*Cupressus torulosa.*
Alder,	..	..	..	*Alnus nepalensis.*

With Rhododendron, *Pieris ovafolia*, the hornbeam, and many others.

In the undergrowth, gigantic ferns, currants and raspberries, with dense and almost impenetrable thickets of ringal, render the task of inspection difficult and uncertain.

The size to which the box will grow under favourable conditions has been generally understated. Mr. Brandis gives "15 to 16 feet in height with a girth of 20 to 30 inches." I measured one tree with a girth of 86 inches at 5 feet from the ground, and trees of 5 feet in girth with a trunk 25 feet to the first branch, and a total height of 40 to 50 feet are often to be found. Unfortunately, however, many of the bigger trees are unsound, and the best size to cut will probably be found to be from 2 to 4 feet in girth.

The reproduction of box in these forests is good, and the young trees are in sufficient numbers to ensure the future of the species in case felling be undertaken.

I do not think that the forests which I have noted by any means represent all that contain box. I often found the villagers suspicious and unwilling to show me the box in their forests, and I think it probable that in many of the moist shady valleys and slopes, with a northerly aspect near the snows, box may be found more or less.

Doubtless, however, the forests dealt with in this report will meet any demand that may arise for box-wood for many years to come. I can hardly venture to hope that the numbers of box trees as estimated by me will be found approximately correct. The trees are often so scattered and the under-growth so dense that, in the total absence of paths, inspection is very difficult. I have endeavoured to give in every case a moderate estimate, and though I have no doubt that there are often more trees than I have noted, I do not think there will ever be found less.

In case fellings be undertaken, the best place to commence will be the village of Mandal, Garhwál, in the vicinity of which a large quantity of excellent box is available from the forests of Panganbasa, Martolia, Dogana, and Chopta. There is a good

road running through these forests to Chamoli, and thence *viâ* Nandprayag, Karnprayag, and Lobha to Ránikhet is only 76 miles. Thence the wood can be carted to Moradabad at a cost of 8 annas a cubic foot. The estimate of cost in the tables at pages 16-17 are based on the supposition that a coolie will carry a cubic foot (65 lbs.) 12 miles for 4 annas, and if the work be done by contract more favourable terms may be obtained. The wood from the forests Nos. 1 to 10 might be delivered at Najibabad *viâ* Kotdwára for about the same cost as at Moradabad.

The total estimated number of trees is 25,000. Supposing a tree is fit to cut at the age of 80 years, we may thus fell 300 trees every year. The average tree will, I think, yield about 3 cubic feet; so 900 cubic feet per annum may safely be cut from these forests.

Mr. Bryant estimates that about 900 cubic feet may be cut in these forests annually, which is an equivalent to about 30 tons landed in England after allowing for dryage. According to Mr. Bryant's calculations the average cost of landing the wood at the Moradabad railway station will be about Rs. 2-5-0 per cubic foot, which is nearly 10 annas per cubic foot more than the cost of the last consignment from the leased forests to Saháranpur.

This, however, is not of much consequence, for it only amounts to about Rs 18 per ton, and, besides this, the cost of carriage will probably be less now that the railway has been brought up to Kátgodam None of the forests reported on are under charge of the Forest Department, and therefore I would suggest that a copy of the report be sent to the Commissioner of Kumaun, to enquire if the forests can be worked by the Forest Department, if Government so orders.

G. Greig.

MANUFACTURE OF CUTCH.

In a letter to the Conservator of Forests, Pegu Circle, British Burma, dated 5th August, 1884, Captain Wood writes as follows:—

I enclose an extract from the "Indian Forester" for July 1884, page 330, and beg to state that in my Circle the season for manufacturing cutch extends to only three months in the year, and that the rates levied here from catechu makers are 12 annas a pot, capable of holding about three gallons of water or liquid substance. The rate has been raised this year from 9 to 12 annas per earthen pot, which even seems to be a very low price compared with what you get in Pegu. I should feel much obliged if you would kindly give me the following information:—

(1). The length of the season during which cutch is manufactured in your Circle.

(2). The outturn per season per cauldron of 20 gallons.

(3). The process of manufacturing as conducted in Pegu.
(4). The price per maund of catechu on the spot.
(5). The distance of the market from the forests where the cutch is sold to retail dealers and others.
(6). What percentage of cutch is obtained from a maund of heartwood ?

The Conservator of Forests, Pegu, replied as follows on the 5th September, 1884 :—

1. Cutch is manufactured in this Circle from 1st June to 31st March ; but the months from December to March (inclusive) are those in which the manufacture is most energetically carried on. In April and May, and in the drier parts in March even, scarcity of water stops the work ; while in the rainy season carts cannot ply, and boilers have difficulties in provisioning themselves and disposing of their cutch.

2. The outturn of a cauldron per season depends on such a variety of circumstances—the duration of the season, the quality of the trees, their proximity to the boiling place, and, above all, the working days of the party, that an average cannot be struck. It may be 2,000 lbs. only, or it may reach, and even exceed, 6,000 lbs. for a cauldron of 20 gallons (those in use have a capacity of 12 gallons).

3. Mr. Carter, Deputy Conservator, Tharrawaddy, well describes the process of manufacture as follows :—

" For the working of one cauldron, three men are necessary ; but if a larger number of cauldrons are employed, there is some saving in labour. Of the three men, one man is employed in felling the trees, and dragging them, by means of cattle, to the cutch boiling place. The second clears the logs of sapwood, and cuts the heartwood into chips. The third attends to the fires and the boiling process. The chips are put into earthen pots, which are filled with as many chips as they will contain ; then water is poured in until the pots are nearly full. The pots (which have a capacity of about 3 gallons) are then placed on the fire and boiled for about 12 hours, in which time the water is reduced to about one-half the original quantity. For one cauldron, 20 to 25 of these earthen pots are employed. The cauldron is nearly filled from these pots, and when the extract in the cauldron is reduced to about one-half, the cauldron is again filled from the pots, and this is repeated until the pots are emptied. The boiling process is generally accelerated by the employment of a large earthen pot, which is set up near the cauldron, and is filled at the same time as the cauldron and kept boiling, the extract from the small pots being constantly added as that in the larger pot is reduced. The cauldron is then filled from the large pot, instead of from the small ones. The Burmans call this large pot the Ye-ni-o, or red water pot. The extract from the pots having all found its way

into the cauldron, the boiling is continued, and the liquid is stirred until it attains the consistency of syrup and fills only about one-fifth of the cauldron. The cauldron is then removed from the fire and stirred with a piece of wood, shaped like a paddle, for four hours or more, by which time the mass has obtained a greater consistency and is cool enough to be handled. It is then placed in a mould, like a brick mould, and is left to cool. This generally happens at night, and by next morning the result is a brick-like mass of cutch weighing 36 to 44 lbs."

The stirring business, which takes place after the cauldron is removed from the fire, is more of a beating up, and I have never been able to ascertain what the object or effect of the process is. Cooks differ too in the amount of beating up that is desirable, some being satisfied with half an hour's application. The outturn of one cauldron of 12 gallons in 24 hours, when properly worked, is fairly constant at the figure given by Mr. Carter.

4. Cutch was worth last year Rs. 4·38 to Rs 5·58 per maund (equivalent Rs. 15, Rs. 20, and Rs. 25 per 100 viss) on the edge of the forest, according to the distance from the Irrawaddy river or the Railway.

5. The above rates correspond to some 40, 25, and 15 miles from the markets on the railway and river, where the price was Rs. 30 per 100 viss (365 lbs.), or Rs. 6·58 per maund.

6. Regarding the amount of cutch yielded by heartwood, no reliable data are available. The yield has been stated at from 3 to 10 per cent. in weight.

For practical purposes, I believe a ton of timber in the round may be taken to yield 250 to 300 lbs. of cutch.

The following note from Captain Wood closes the correspondence :—

It appears that in Pegu the cauldron is used for the final concentration, and the price is regulated by it. 20 to 25 pots of the size used in Oudh are used to supply the 12 gallon concentrating cauldron, so that the prices levied are much the same in both provinces, as will be seen by the figures given below :—

	Rs.	A.	P.
Pegu.—Price for 4 months' working 12 gallons cauldron, *i.e.*, 20 to 25, say 22½, 3 gallon pots = ...	20	0	0
22½ pots at 12 annas = ...	16	14	0
Add ⅓ more for the 4th month = ...	5	10	0
	22	8	0

REPORT ON CERTAIN ASSAM SLEEPERS LAID ON THE NORTHERN BENGAL STATE RAILWAY FOR EXPERIMENT.

THREE several lots of sleepers were received from the Forest Department in Assam, *viz.* :—

(*a*). 100 Jarul,
100 Sama,
40 Gondsoroi, } received, latter end of 1879.

(*b*). 60 Gondsoroi,
100 Sida } received, July 1881.

(*c*). 20 Nahor, received, 4th January, 1882.

Of these lots (*a*) and (*b*) have been laid experimentally. The third (*c*) lot appears to have been received without any advice being given about them, so that they have probably become mixed up with and issued as ordinary sleepers for maintenance purposes.

Of the various kinds of sleepers supplied, the sama appears to be the best, as after more than five years' life in an unballasted siding there are still 71 per cent. in good and 12 per cent. in fair condition. No sleepers of these woods have had a fair test in a ballasted portion of the main line, except some sida (*Lagerstrœmia parviflora*) sleepers received at Siliguri, and which were not found suitable. I would therefore suggest that 50 or 100 sleepers of each of the following woods be obtained from the Assam Forest Department for further experiment :—

Jarul—*Lagerstrœmia Flos-Reginæ.*
Sama—*Artocarpus Chaplasha.*
Gondsoroi—*Cinnamonum glanduliferum.*
Nahor—*Mesua ferrea.*

Report on experimental Assam jungle wood sleepers, March 1885.

1st Lot (a). 240 sleepers laid in January 1880 in the new half mile extension of Kaunia goods shed siding (unballasted).

		Removed.	Condition.			Total.	Remarks.
			Good.	Fair.	Bad.		
40 Gondsoroi wood, mark G 79,	Numbers, ...	1	19	9	11	40	Sleepers shown, as in fair condition, are slightly rotten, and those, as bad, are either badly split or rotten.
	Percentages, ...	2 5	47·5	22·5	27 5		
100 Jarul wood, mark J 79,	... ..	7	48	11	34	100	
100 Sama wood, mark S 79,	... ...	2	71	12	15	100	
						240	

2nd Lot (b). 160 sleepers laid on 15th July, 1881, in the Rungpur Branch main line just outside western facing points, Kaunia Station (line ballasted).

60 Gondsoroi wood,
100 Sida "

Note:—Only 53 out of the 160 sleepers now bear marks, *viz.*, 17 with mark E 81, and 36 with mark S 81. These sleepers were marked with small tin plates bearing the marks and nailed to the sleepers. Only the nails which held the tin plate marks now remain in the balance of the 160 sleepers. The tabulated report is given below, but it can be of very little use except to give an idea of the relative value of a mixture of gondsoroi and sida wood sleepers as compared with sleepers of known woods.

	Removed.	Condition.			Total	Remarks.
		Good	Fair.	Bad.		
Mark E 81,	...	5	3	9	17	Sleepers shown, as in fair condition, are slightly split or rotten, and those, as bad, are either badly split or rotten.
Mark S 81,	...	11	11	7	36	
No mark,	...	16	16	30	107	
					160	

A. GREENLEES,

Superintendent of Way and Works.

Note.—This report disposes of sida for use on Bengal railways, though it has been recommended under the name of dhaura for the Oudh and Rohilkhand line. It is a pity that nahor did not get a trial, as it is far more abundant in Assam than the other woods.—[ED.]

REPORT ON SPIDER SILK FROM KUMAUN IN THE NORTH-WESTERN PROVINCES AND OUDH.

Mr. J. F. Duthie, F.L.S., Superintendent of the Government Botanical Gardens at Saharanpur, recently transmitted to Sir J. Hooker, Director of the Royal Gardens, Kew, a specimen of spider silk obtained by him in Kumaun. Mr. Thos. Wardle, of Leek, a well-known authority on Indian fibres and silks, who was consulted regarding the samples, furnishes the following report :—

"Sir George Birdwood has written to me enclosing some spiders' web and an extract from Mr. J. F. Duthie's letter. He asks me to examine this spider silk and to reply directly to you.

"The following is the result of my examination :—

"The fibre is evidently of a silken nature, and, like silk, it is loaded with a gummy substance. In a boiling soap solution this gum or varnish dissolves, leaving the fibre apparently pure and of the nature of fibroin, if not identical with it.

"Eight micrometric measurements of the diameter of the fibre in different parts of the mass showed great irregularity in thickness ($\frac{1}{2500}$, $\frac{1}{2800}$, $\frac{1}{3500}$, $\frac{1}{2800}$, $\frac{1}{3500}$, $\frac{1}{3500}$, $\frac{1}{3500}$, $\frac{1}{3500}$ inch,) giving an average of $\frac{1}{3100}$ inch. It has therefore a considerably finer thread or fibre than silk, Italian silk averaging in thickness $\frac{1}{2100}$ inch.

"The average strength of the spider silk is proportionately greater than that of silk, a single fibre of the spider silk breaking with an average weight of $2\frac{1}{4}$ drams Avoirdupois, whilst that of China silk breaks at $2\frac{1}{8}$ drams.

"The most curious property of this fibre is its elasticity, which is considerably greater than that of silk; 30 centimetres of it will stretch to an average length of 36·3 centimetres before breaking, whilst China silk will only stretch to 34 centimetres.

"Like silk this spiders' web silk is lustrous and has a round fibre.

"Its coating of gum or varnish is disproportionate to the weight of the silk. On boiling with soap it lost 7¾ oz. per lb., that is, 1 lb. of the spider silk discharges 7¾ oz. of gum. With silk the proportion is much less, seldom being over 25 to 30 per cent. Before boiling in soap the spider silk was well combed to remove all the dirt possible, but a little remained.

"The fibre appears to dye readily. I enclose a small pattern of it dyed, and also one as I received it, and one after boiling in soap.

"I believe if it can be obtained in quantity, it might be packed in bales and sent to England, where it would readily find a market for being carded and spun into spun silk thread for sewing or weaving purposes.

"It is difficult to estimate its marketable value. I dare say it would at any rate realise 2*s.* per lb. It is rather dirty, and this would to some extent detract from its value as compared with silk waste.

"I have tried to discover how many seripositors this spider has, but beyond noticing under the microscope that the fibres often run in pairs, but not regularly, I am unable to trace whether there are two, as in the ordinary silkworm, or more. Probably an examination of the spider would show this, or an undisturbed portion of its secreted silk."

Mr. Duthie believes that, if a large supply of the spider silk were wanted, it could easily be obtained near the lake at Bhim Tal in Kumaun after the rainy season is over.

CULTIVATION OF *CRYPTOSTEGIA GRANDIFLORA* IN BOMBAY.

THE seed of the *Cryptostegia grandiflora* is reported to have germinated freely in Násik and Satara, and the seedlings to be doing fairly well. In Thána the results were not so favourable, as by far the greater number of seedlings that germinated died off.

In Sholápur the seed is said not to have germinated; this is due probably to mismanagement. In the Panch Maháls the seed supplied was destroyed by rats. In Nagar the seed was not sown, as the plant is known to grow there like a weed.

I may add that this plant is cultivated in gardens in nearly every station in India, and can be easily propagated; the experiments made by the Divisional Forest Officers prove nothing more than what was already known about the plant to those who are interested in it. The cost of collecting the sap would be so great that a plantation is not likely to be commercially successful. The plant grows wild in the Western Ghát.

J. G. McRAE.

IV. Notes, Queries and Extracts.

THE VALUE OF THE EUCALYPTS AS TIMBER TREES.

By D. Howitz, *Forest Conservator.*

The Eucalypts, or Gum-trees as they have been called, have of late years attracted a great deal of attention on account of their healthy properties, but their value as timber trees has hitherto not penetrated to the great markets. There have been several reasons for this, the distance from far-off Australia, their native place, the difficulty of transport to the shipping place, the peculiarities of the wood, which as a rule is very heavy and hard, and last, but not least, that people have not known the quality of these timber trees, nor quite understood how to treat them. There is as yet a large field open for experience with these trees, but as it is likely that they will play a prominent part in the near future, it may not be without interest to know a little of their general character and utilization.

The first objection, *viz.*, the distance to the great markets, will in a few years be somewhat modified by the introduction of the more valuable Eucalypts on a large scale nto the countries around the Mediterranean, and particularly in the colony of Algiers, where the cultivation of these valuable trees is being executed at a great rate. As the Eucalypt timber gets more known, the demand for the more valuable kinds and dimensions will also cause a brisker trade in Australia, and thereby lessen the freight and the cost as better means of obtaining these dimensions are discovered.

Foremost amongst the Eucalypts, of which a couple of hundred species are known in Australia, the great home for the whole Myrtle family, stands the Jarrah tree (*E. marginata*) of Western Australia, where it is found on the ironstone ranges along the coast. The exact extent of the vast forest containing Jarrah timber cannot be exactly ascertained, as this tree gradually gives room for other trees, but Baron von Müller, the celebrated botanist, maintains that the belt stretches from the Collie River as the southern boundary as far as the Hershel ranges, in a width of varying size. The wood is brownish, and if taken from dense forest of a straight and even texture, hard, resinous, closely grained, and particularly from rocky ground of

an oily appearance. It receives a fine finish and polish, and ship-builders prefer it to teak and oak. This wood is exceedingly durable, but its chief virtue consists in the now recognised fact that it resists the attack of the "teredo navalis" as well as that of other insects destructive to timber in exposed positions. It is therefore extremely well suited for piles, wharves, railway sleepers, and telegraph poles, and as it also resists the attack of fungi or rot caused by putrid water, it should find a prominent place as wood pavement. In Australia it is a common theory that vessels built of this wood do not require copper plating, a fact only mentioned to show that it resists animal or organic parasitical life. India has already during several decades been monopolizing this tree for railway sleepers, and a great export trade has long taken place from Perth to various places in India. On the south-eastern part of Australia is found a congener, called the Bastard Jarrah (*E. botryoides*), which resembles the Jarrah, but its wood is not so durable or oily and does not resist the attacks of insects so well. The Bastard Jarrah is found in Gippsland, in the colony of Victoria, where it forms fine forests. It grows taller and furnishes straighter and larger dimensions than the Jarrah, and though not so durable as that tree is still a most valuable timber tree. In Western Australia there were about thirty saw-mills in 1882, and most of these were only employed on the Jarrah for sleeper-cutting.

The next in rank should be the Red Gum (*E. rostrata*), on account of its durability when used for underground work. This tree is a native of Southern Australia, where it is found on river flats, in swamps, and on the plains. The wood is reddish, resinous, hard, works well, and receives a high degree of polish. Ship-builders utilize it extensively for all purposes where strength and hardness are required. If used for planks the wood should be steamed before use. This tree is being cultivated largely in Algiers, and it will not be many years before its presence there will make itself felt on the flats at Lacalle, and near Bona, where this tree seems to prosper and grow exceedingly well, but no information is as yet to hand about its timber value. For railway sleepers it is extremely well suited, and even in very awkward positions it has been known to last for upwards of 23 years before showing signs of decay. Also for wood pavement this timber should be utilized ; and as it resists the attacks of insects nearly as well as the Jarrah, it should take a prominent place in importation for that purpose. To this class belong also the so-called "Flooded Gums" of South Australia and New South Wales, but as transport to the seaports is difficult, and they do not play a very prominent part, they are only mentioned here.

There are many more valuable Eucalypts, but I will not weary the reader with their names and descriptions, and only remark that amongst them are found the hardest and most

durable woods known, for experience has shown that some of them are practically everlasting as fencing posts and sleepers, wear and tear, of course excepted. The large giant tree, the Stringybark (*E. obliqua*), furnishes immense dimensions of a light fissile wood, useful for shingles, rails, &c.. and when it becomes more known, perhaps some more paying use might be found for it, while some of the mahogany Eucalypts furnish beautiful wood for cabinet-making and ornamental work. With the present facilities for transport it is a curious fact that these timber trees are so little known in the timber market, where they ought to take a very prominent place, and it is also curious that the greatest part of these woods are exported to India and to America, while Europe knows little or nothing about them. The most practical way to test the value of these timber trees would most likely be to form a company of timber merchants to deal with the matter, and then, after having communicated with the various agent-generals in London to send a practical man out to make himself acquainted with the various places, and to form business acquaintance with the saw-mill owners, so as to secure a supply of good timber to throw on the market. I have no doubt that the public would back such an effort, and I feel sure that the Australian colonies would, singly and collectively, do their utmost to aid the success of the undertaking, whereby everybody would be a gainer.

The next important Eucalypt should be the Karri of Western Australia (*E. diversicolor*, Müeller) on account of the large dimensions of a straight even-grained timber which it furnishes. This timber is much sought for masts and ship-building, and is not so heavy as the before mentioned, but of a lighter and more elastic character. The tree is of a rapid growth and reaches a great height and considerable girth. In the valleys and on the flats in South-west Australia colossal Karries are found, frequently reaching a height of 300 to 400 feet and a girth of 40 to 50 feet about 6 feet from the ground, but it is rarely found except in mixture with other Eucalypts. Most important is also the so-called Ironbark tree (*E. Leucoxylon*) found mostly in Southern Australia, although it does not furnish such large dimensions as the above named. The wood of this tree is close grained, firm, and of remarkable elasticity and durability. Carpenters, ship-builders, and wheel-wrights use it, and for treenails, rudder stocks, belaying pins, blocks, &c., as well as for wheels, spokes, &c., it cannot be surpassed. There are already several saw-mills at work, and there is room for many more, as the supply is very great. For axe handles and handles in general it excels the hickory (*Carya alba*) both as regards durability and elasticity, and as this valuable tree prefers a rocky, stony ground it will most likely be cultivated to a very large extent on the otherwise useless ranges. This tree has received some attention in Algiers, whence it may confidently be expected that a good supply will

be obtained before many years. The Ironbarks of New South Wales and Queensland furnish also most valuable timber of this kind, and will, no doubt, be cultivated largely as soon as the demand for them arises; but the ignorance of the European market with regard to them has caused them to be but little appreciated as yet, and consequently the forests have not been properly protected.—*Timber Trades Journal.*

School of Forestry and Museum.—The lithographed circular to proprietors and others largely interested in the subject, signed by the Marquis of Lothian, was issued on January 28th.

The Committee, in a note, state that they feel a difficulty in suggesting a definite scheme for the proposed School of Forestry, until they have some knowledge of the amount of funds which may be placed at their disposal; but, in the meantime, it may be sufficient to state that they contemplate the establishment of a Professorship of Forest Science, for the instruction of students in all that pertains both to practical and scientific forestry—including the physiology and pathology of trees, the climatic and other effects produced by forests, the different methods of forest management, the economic uses to which forest products have been or may be applied, forest engineering, and forest administration generally. Instruction is to be communicated by lectures, examinations, excursions, &c.

A large collection of forest implements, produce, and specimens was, at the close of the Forestry Exhibition, placed at the disposal of the committee for use in connection with the proposed Forest School; and it is the intention of the Committee, should their funds permit, that this collection should, with such additions as may from time to time be available, be placed in a permanent museum in connection with the School of Forestry.

The Committee earnestly trust that sufficient funds may be subscribed to warrant their proceeding with the objects they have in view, and that Great Britain, with her enormous forest interests in all parts of the world, may no longer be almost the only civilized country without an efficient School of Forestry. Intimations of subscriptions are to be made to Colonel Dods, Secretary, at the United Service Club, Edinburgh. An after appeal will be made to the general public. The Council of the Scottish Arboricultural Society have agreed to recommend their constituents to vote £50 from the Society's funds for the above object.—*Forestry.*

Origin of the Sahara.*—From the observations made at various points in recent times it has become more and more evident that the Sahara can no longer be regarded as having been a

* From Review of Dr. Oskar Lenz's Timbuktu, *Nature*, April 16th, 1885.

marine basin at least since the early Tertiary epoch. The theory may be said to have received its *coup de grâce* from Dr. Lenz, who plainly shows that the whole of the western section traversed by him is not a depression, as has been assumed, but an irregular plateau standing in the north at a mean elevation of from 800 to 1,000 feet, and even at Taudeni, its lowest level, still maintaining an altitude of 400 or 500 feet above the Atlantic. The surface is varied with stony and sandy tracts, the so-called "areg" or "igidi," which have nothing in common with marine sedimentary deposits, but have, in fact, been produced by the weathering of sandstone, quartz, and carboniferous limestones, which appear to be the prevailing formations. It is thus evident that this part of the desert has been dry land for vast ages, and the same conclusion must be inferred from the numerous dried-up water-courses, whose deep channels are distinctly the effect of erosion. These wadies, many of which seem to have been flooded within the last few thousand years, radiate from the central highlands north and north-east to the Mediterranean, east to the Nile, south to the Tsad and Niger, west to the Atlantic. Hence down to comparatively recent times the Sahara was a well-watered and wooded region thickly inhabited by agricultural and pastoral communities, themselves the descendants or successors of still more primitive peoples, the contemporaries of Palæolithic and Neolithic man in other parts of the globe. In the Taudeni district, about 20° N., under the meridian of Timbukru, Dr. Lenz discovered some implements of hard greenstone well worked and polished, and similar objects have also been found by Gerhard Rohlfs as far west as the Kufara oasis south of Tripolitana. The Asiatic camel is here a comparatively recent intruder, preceded by the Garamantian war-horse and by the elephant, trained also to war by the native Numidians and Phœnician Carthaginians. The crocodile even still survives in many of the pools and lakelets here and there marking the course of mighty streams, which formerly sent their perennial floods down to the surrounding marine basins.

Apart from possible cosmic influences, our author attributes the great change that has taken place within the historic period, not with Peschel to the dry north-east Polar winds, which in the Sahara yield to the prevailing northern and north-western atmospheric currents, but largely to the reckless destruction of the woodlands which at one time covered vast tracts in this now arid and treeless region. With the vegetation disappeared the moisture; all the large fauna became extinct, and the settled populations were succeeded by nomad tribes of Berber (Hamitic) stock, joined later on by Semites from the Arabian Peninsula.

OBITUARY.—We have heard, with very great regret, the news of the death, on the 5th of April, at Badbol in Germany, of Mr.

Edwin Fuchs, Assistant Conservator of Forests, in Bengal. He was appointed by the Secretary of State to the Forest Department, in 1871, and after studying in Germany, reached India in December 1873, and was posted to the Kuch Behar division in Bengal, early in January 1874, where he was chiefly employed in making valuation surveys in the Sivôk Hills; he was attached to the Darjeeling division, from April to July 1875; in temporary charge of the Julpaigori division till January 1876, and then of the Buxa sub-division till 1878, when he was transferred to the Teesta division. In 1880, he was posted to the Hazaribagh division, his work being chiefly in Singbhúm, where he remained till he availed himself of furlough, on medical certificate, on the 15th May, 1883. Whilst on leave he served as a juror, at the Edinburgh Forestry Exhibition.

His chief work has been the demarcation of reserves in the Buxa Duárs of the Julpaigori district, in the Kalingpong subdivision of the Darjeeling district and in Singbhúm, and for his good management and excellent services, especially in the unhealthy Singbhúm forests, he was specially commended by his Conservator, and by the Lieutenant Governor of Bengal. His health has suffered considerably, first in Buxa and subsequently in Singbhúm, and he has consequently been frequently compelled to avail himself of sick leave, at intervals throughout his service.

As the reserves are demarcated, and proper accommodation is provided for Forest officers, forest work in such unhealthy forests as those of the Bengal and Assam Duárs, and Chota Nagpur loses much of its dangers, but it should not be forgotten that much of the progress made in India is due to the brave self-devotion of men like the late Mr. Fuchs, on whose services as pioneers of unexplored forests the future success of our department is largely based.

A CONTEMPORARY learns that the Forest Conservators and the Board of Revenue at Madras have reported unfavourably on a suggestion that a School of Forestry should be opened in connection with the Agricultural College at Saidapet. It is considered that the present plan of sending students to the Forest School at Dehra Dún cannot be improved upon. It is further pointed out that in any case Saidapet would not be a suitable place for such a school, inasmuch as the place does not possess the forest surroundings requisite for practical instruction.

We wonder whether the Poona Forest classes, which are attended by Forest subordinates in the Bombay Presidency, have greater advantages than Saidapet, or whether the students there pass ten months in practical forest work in forests organized like those of the School Circle, North-Western Provinces, under the constant instruction of experienced Forest officers.

It would also be interesting to know whether training in practical surveying, equal to that of the Imperial Forest Survey, is provided at Poona.

We have heard that the Bombay Government object to the distance of Dehra, but this is found no obstacle in the case of Baroda, one of their own States, which sends Forest students to Dehra in preference to Poona, nor in the case of Madras, Assam, and Burmah, which are certainly less accessible to Dehra than Bombay.

CINNAMONUM OBTUSIFOLIUM.

Mr. Peal writes that *Cinnamonum obtusifolium* is wrongly named, the leaves being fairly *acute*, unless bitten off by insects, which is commonly the case, and this may have given rise to the idea that they are *obtuse*.

V. EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA—

No. 454.—*The 21st May, 1885.*—The following temporary promotions are made during the absence on three months' privilege leave of *Captain E. S. Wood*, Conservator of Forests of the 2nd (officiating 1st) grade in Oudh, with effect from the 28th April, 1885 :—

Mr. C. J. Ponsonby, Deputy Conservator of Forests of the 1st grade in Oudh, to officiate in the 3rd grade of Conservators of Forests, and to have charge of the Forest Department in Oudh, in addition to his own duties.

Mr. R H. M. Ellis, Deputy Conservator of Forests of the 2nd grade in Bengal, to officiate in the 1st grade of Deputy Conservators of Forests.

No. 457.—*The 21st May, 1885.*—*Major G. J. vanSomeren*, M.G.L.I., Conservator of Forests of the 3rd (officiating 2nd) grade in Berar, is appointed to officiate in the 1st grade of Conservators of Forests, with effect from the 28th April, 1885, during the absence on furlough of *Lieutenant-Colonel J. C. Doveton*, M.S C., Conservator of Forests in the Central Provinces, or until further orders.

No. 463.—*The 22nd May, 1885.*—The undermentioned officiating Assistant Conservators of Forests of the 3rd grade are appointed substantively *pro tempore* to be Assistant Conservators of the 3rd grade, with effect from the 7th February, 1885 :—

Mr. A. E. Lowrie,	...	...	Ajmere.
„ *E. Murray*,	...	...	Punjab.
„ *J. E. Barrett*,			

2.—CALCUTTA GAZETTE—

The 1st May, 1885.—The Conservator of Forests, Bengal, is appointed to be an *ex-officio* member of the Central Examination Committee, Calcutta.

The 12th May, 1885.—Consequent on the return from furlough of *Mr. A. J. Mein*, Deputy Conservator of Forests, 3rd grade, in Assam, the following reversions will take effect from the 29th March, 1885 :—

Mr. W. M. Green, Officiating Deputy Conservator of Forests, 3rd grade, reverts to his substantive appointment in the 4th grade of Deputy Conservators

Mr. C. A. G. Lillingston, Officiating Deputy Conservator of Forests, 4th grade, reverts to his substantive appointment in the 1st grade of Assistant Conservators.

The following notification is published in supersession of the

one, dated the 12th May, 1885, which appeared in the *Calcutta Gazette* of the 13th idem, Part I, page 425, under the head "Forest Department":—

The 16th May, 1885.—Consequent on the return from furlough of *Mr. A. J. Mein*, Deputy Conservator of Forests, 3rd grade, the following reversions will take effect from the 4th April, 1885:—

Mr. W. M. Green, Officiating Deputy Conservator of Forests, 3rd grade, reverts to his substantive appointment in the 4th grade of Deputy Conservators.

Mr. C. A. G. Lillingston, Officiating Deputy Conservator of Forests, 4th grade, reverts to his substantive appointment in the 1st grade of Assistant Conservators.

3.—NORTH-WEST PROVINCES AND OUDH GAZETTE—

Nil.

4.—PUNJAB GAZETTE—

No. 222.—*The 1st May, 1885.*—*Mr. R. J. P. Pinder*, Assistant Conservator of Forests, from the Lahore to the Hazára Division, which he joined on the 5th March, 1885, after noon.

No. 236.—*The 7th May, 1885.*—*Mr. E. Forrest*, Deputy Conservator of Forests, from the Hazára to the Jhelum Division.

He made over charge of the former on the afternoon of the 7th April, 1885, and received charge of the latter on the afternoon of the 11th idem.

No. 238.—*Mr. A. M. Reuther*, Deputy Conservator of Forests, from the Jhelum to the Lahore Division.

He made over charge of the former on the afternoon of the 11th April, 1885, and received charge of the latter on the afternoon of the 18th idem.

5.—CENTRAL PROVINCES GAZETTE—

No. 1715.—*The 7th May, 1885.*—*Mr. A. Watson*, Assistant Conservator of Forests, has passed the Lower Standard Examination in Hindustani.

No. 1909.—*The 22nd May, 1885.*—*Lieutenant-Colonel J. C. Doveton* reported his arrival at Bombay on the 18th current, on return from the furlough granted him by G. O. No. 258, dated 11th April, 1883, of the Madras Military Department.

Lieutenant-Colonel Doveton assumed charge of the office of Conservator of Forests, Central Provinces, on the forenoon of the 21st current, from *Mr. R. Thompson*, Officiating Conservator of Forests.

6.—BRITISH BURMAH GAZETTE—

No. 4.—*The 1st May, 1885.*—*Maung Shwe Gon*, Probationer, Forest Department, availed himself, on the forenoon of the 1st December, 1884, of the six months' leave on medical certificate granted him in Revenue Department Notification No. 25F., dated the 7th April, 1885.

No. 5.—*Mr. J. N. Pickard*, Deputy Conservator of Forests, availed himself, on the forenoon of the 4th April, 1885, of the one year's furlough granted him in Revenue Department Notification No. 24F., dated the 6th idem.

7.—ASSAM GAZETTE—

No. 130.—*The 30th April, 1885.*—*Mr. A. J. Mein*, Deputy Conservator of Forests, returned to duty in Assam on the forenoon of the 4th April, 1885, and received charge from *Mr. J. T. Jellicoe*, of the Kámrúp Division on the forenoon of the 13th April, 1885.

No. 137.—*The 2nd May, 1885.*—Privilege leave of absence for three months, under Sections 71 to 74, Chapter V. of the Civil Leave Code, is granted to *Mr. C. G. D. Fordyce*, Assistant Conservator of Forests, Sibságar, with effect from the 30th April, 1885, or from the subsequent date on which he may take it.

No. 138.—*Babu Sri Gopal Bannerji*, Forest Ranger, is appointed to hold charge of the Sibságar Forest Division during the absence of *Mr. C. G. D. Fordyce.*

No. 152.—*The 14th May, 1885.*—*Mr. T. J. Campbell*, Assistant Conservator of Forests, 3rd grade, is promoted to the 2nd grade of Assistant Conservators, with effect from the 7th February, 1885.

8.—MYSORE GAZETTE—

Nil.

9.—MADRAS GAZETTE—

No. 115.—*The 22nd April, 1885.*—*Mr. G. Homfray*, Assistant Conservator of Forests, 3rd grade, to act as District Forest Officer, Godavari district.

No. 126.—*Mr. A. W. Lushington*, Acting Assistant Conservator of Forests, 1st grade, to be District Forest Officer, Ganjam.

No. 135.—*The 13th May, 1885.*—*Mr. G. Homfray*, Assistant Conservator of Forests, 3rd grade, examination leave for two months from the date of availing himself of the same.

No. 137.—*Mr. J. H. B. Brougham*, 1st grade Assistant Conservator of Forests, to act as Deputy Conservator of Forests, 4th grade, during the absence of *Mr. R. W. Morgan* on privilege leave.

Erratum.—*The 14th May, 1885.*—In notification dated 30th January, 1885, published at page 331 of the *Fort St. George Gazette*, dated 24th February, 1885, Part II—

For "*T. Daniel Pillay*, Forest Ranger, 5th grade, on probation, Kurnool,"

Read "*A. Daniel Pillay*, Forest Ranger, 5th grade, on probation, Kurnool."

10.—BOMBAY GAZETTE—

The 20th April, 1885.—*Mr. H. Barrett*, Deputy Conservator of

Forests, delivered over charge of the office of the Divisional Forest Officer, Dhárwár, to *Mr. H. Murray*, Assistant Conservator of Forests, on the forenoon of the 16th instant.

The 22nd April, 1885.—Messrs. J. K. Spence, C.S., Collector of Panch Maháls, and *H. W. Keys*, Assistant Conservator of Forests, respectively delivered over and received charge of the office of the Divisional Forest Officer, Panch Maháls, on the 14th instant, before office hours.

The 23rd April, 1885.—Messrs. H. Barrett and *H. Murray* respectively delivered over and received charge of the Divisional Forest Officer, Northern Division of Kánara, on the 13th instant, before office hours.

Messrs. H. Murray and *W. A. Talbot* respectively delivered over and received charge of the office of the Divisional Forest Officer, Northern Division of Kánara, on the 18th instant, before office hours.

No. 3552.—*The 4th May, 1885.—Mr. Náráyan Ballál Oke*, Sub-Assistant Conservator of Forests, 1st grade, is allowed an extension for three months of the leave on medical certificate granted to him under Government Notification No. 1300, dated 12th February, 1885.

The 6th May, 1885.—Mr. B J. Haselden, Sub-Assistant Conservator of Forests in charge Kanara Saw Mills, who was granted in Government Resolution No. 3325, dated the 24th April, 1885, privilege leave for one month, delivered over charge of his office to *Mr. T. R. Bell*, Divisional Forest Officer, C. D., of Kánara, on the 4th May, 1885, after office hours.

No. 3648.—*The 6th May, 1885.—Mr. H. Mainwaring*, Deputy Conservator of Forests, 4th grade, has been allowed by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

No. 3662.—*Mr. Hugh Hurray*, Acting Assistant Conservator of Forests, 1st grade, passed on the 7th April, 1885, an examination in Kánarese according to the Higher Standard, under Rule 7 of the rules published in Government Notification No. 2878, dated 4th June, 1880, for the examination of Forest Officers.

No. 3991.—*The 19th May, 1885.—Mr. A. D. Wilkins*, Assistant Conservator of Forests, 1st grade, and Divisional Forest Officer, North Thána, is allowed privilege leave of absence for three months from 16th June, 1885, or from such subsequent date as he may avail himself of it.

NOTICE.

A list has been received from the Manager of the Delhi and London Bank, Mussoorie, showing that many Subscribers to the 'Indian Forester' have not yet paid their subscriptions for Vol. X. As the cost of publication is barely covered by the amount of the subscriptions, it is hoped that these gentlemen will kindly send remittances without further delay, and a post card has now been sent to each of them as a reminder.

It is proposed to publish the names of Subscribers whose subscriptions are more than one year in arrears, and it is hoped that after due notice has here been given, that our supporters will not take offence at this necessary procedure.

Subscribers are also reminded that subscriptions for Vol. XI. are already due.